SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1887, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVII.—No. 26. [NEW SERIES.] NEW YORK, DECEMBER 24, 1887. [$3.00 per Year.

THE WATERTOWN ARSENAL TESTING MACHINE.

The great testing machine at the United States Arsenal at Watertown, Mass., in the environs of Boston, is properly considered one of the engineering triumphs of its day. A machine which will break by tension a five inch bar requiring 350 tons stress, and immediately after the strain and shock of recoil due to this performance will break a horse hair, and indicate perfectly the required rupturing tension of one pound, must be mechanically perfect. It is told of the Emperor William of Germany that, when visiting Krupp's works, he placed his watch on the anvil under the great hammer. The attendant brought the hundred ton ram down on the piece without injuring it. The watch was thereupon presented to him. The same class of test has been applied to the Watertown machine. A compression of 1,000,000 lb. was first produced, and immediately afterward eggs and nuts were cracked and violin strings stretched. By the very peculiar construction of the indicating apparatus, friction in that part seems to have been almost entirely done away with. The single resistance left, as regards its registration, is the molecular friction or stiffness of very thin metal plates, which have only to yield to an infinitesimally small extent of motion or flexure.

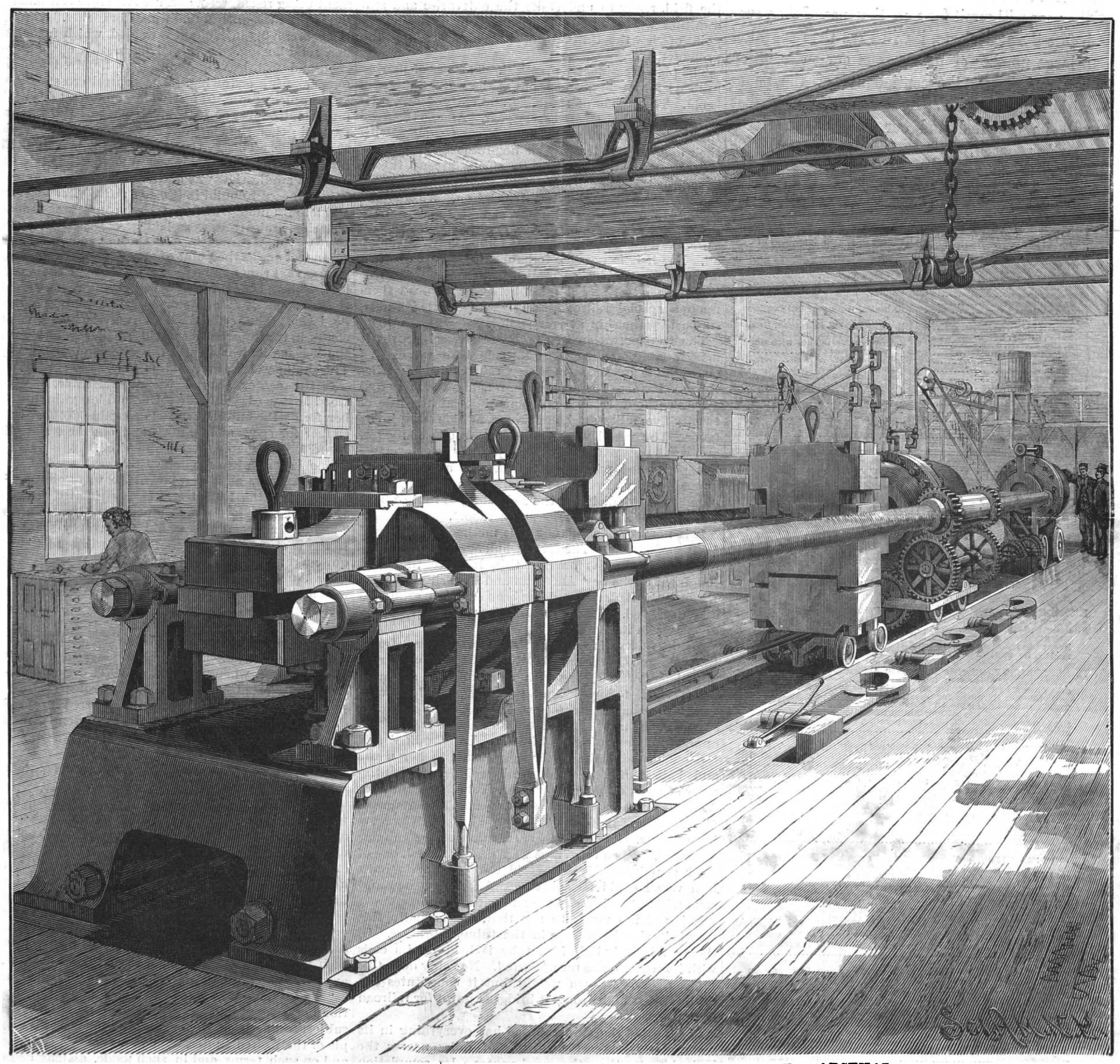
The machine was designed according to the ideas and inventions of Mr. Albert H. Emery. It was built at the works of the Ames Manufacturing Company, of Chicopee, Mass. The principal castings, embracing 80,000 lb. of gun iron, were made at the South Boston Iron Works. The forgings in steel and iron were produced at the Nashua Iron and Steel Works. The finished metal work includes bronze, cast and wrought iron, and steel. The largest casting weighs 14,000 lb., while of some pieces a great number would be required to weigh a single ounce. The cost to the United States government is stated as follows:

Machine, with pump and accumulator	$31,500 00
Erection	4,000 00
Foundation and accumulator pit	4,083 77
Traveling crane	2,981 23
Steam pipes for heating building	439 52
	$43,004 52

It was completed in 1879, and is said to have cost the contractors more than double the above amount.

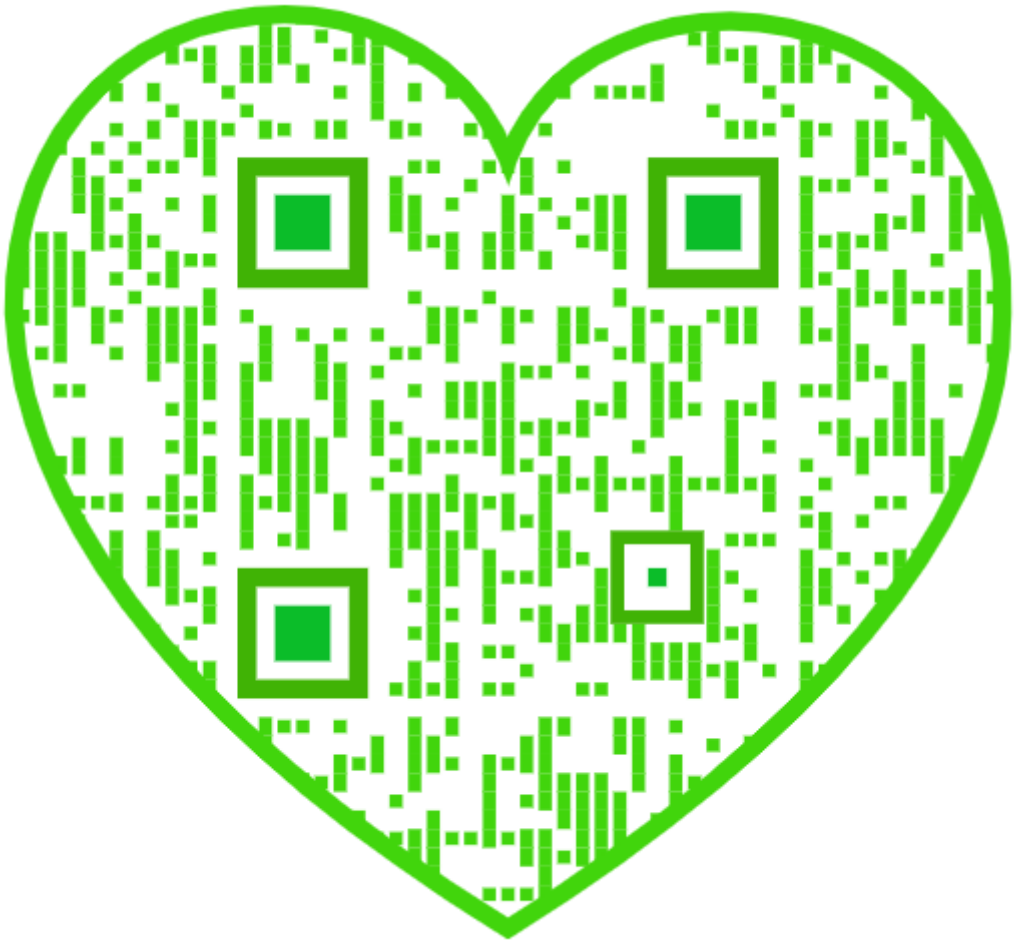
The machine works by hydraulic pressure for heavy strains, while for light ones, and especially for such as require a very large range for stretching or contracting, screw power can be effectively applied. The apparatus in general is thus arranged: A line of rails carries a traveling ram, which produces the stresses. This is mounted on wheels that fit the track. To move it, screws that run parallel with the track are provided. These are held by an immensely strong abutment at one end of the machine and by simple uprights at the other. The traveling ram is provided with nuts on each side, through which the screws pass. By turning these nuts the ram is moved backward or forward. At one end, where the abutments are situated, and attached to them, are the weighing platforms. These act upon four cylinders and pistons forming rams, but of very slight play. The axes of these cylinders are horizontal. The space between piston and cylinder

(*Continued on p.* 407.)



THE UNITED STATES TESTING MACHINE AT THE WATERTOWN ARSENAL.

© 1887 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 24, 1887.

The next issue closes another volume, and if those subscribers to this paper—and there are several thousand of them—whose term ends with the year will remit for a continuance of the paper before the year closes, it will save the removal of a large number of names from our subscription list, and insure the continuance of the paper without interruption. By so doing the subscriber will be benefited and our subscription clerks greatly relieved.

Contents.

(Illustrated articles are marked with an asterisk.)

Ax helves, improvement in attaching* 403
Boot or shoe heel, machine for forming* 403
Business and personal 410
Car heater, fireproof, improved* 403
Car heater, safety, improved*.... 403
Car, street, electric 404
Cart, dump, improved*..... 402
Correspondence..... 405
Door bolt, improved*..... 403
Driven well case, the..... 405
Dyeing and bleaching apparatus, centrifugal*..... 406
Elevator, safety, automatic*..... 404
Flea, the 408
Gas pressure, 600 pounds..... 409
Gate, improved*..... 403
Grindelia spirosa..... 405
Hobby, value of a 405
Horse, memory of the..... 409
Inventions, agricultural..... 410
Inventions, engineering..... 410
Inventions, index of..... 411
Inventions, miscellaneous..... 410
Jib hank, improved*..... 402
Lacharme, Francois. 404
Lamp for Christmas trees*..... 404
Law, uncertainty of the..... 405
Lumber, raft of, great..... 400
Motor, man with a, the way of.. 401
Navy, Secretary of, annual report 401
Notes and queries..... 411
Patent "innocents" again in Congress..... 400
Pigeons, young homing, flight of 401
Rabbit plague in Australia..... 408
Retriever, a noble..... 405
Rhine Falls, proposed utilization of..... 407
Rock salt find at Ellsworth, Kas 405
Rocker for chairs, improved*.... 404
Scientific experiments with simple apparatus*..... 409
Self-control..... 405
Ship railroad, the Eads..... 400
Soap from water, recovery of.... 406
Spectacles for horses..... 404
Testing machine, Watertown Arsenal*..... 399, 407
Tomb, Etruscan, articles found in an*..... 403
Torpedo boats, transportation of, on railroads*..... 402

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 625,

For the Week Ending December 24, 1887.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY.—Alkaloid-like Bases in Paraffin Oil.—A very curious and interesting investigation; the properties of the new bases described 9990
Synthesis of a Sugar.—The last triumph in constructive chemistry; the reactions involved and the properties of the new substance; its want of action on polarized light..... 9990

II. ELECTRICITY.—Electric Railways in America now in Operation.—A valuable statement of length and number of cars and other data of roads constructed or projected in this country..... 9982
On Storage Batteries for Electric Locomotion.—By Prof. ANTHONY RECKENZAUN.—An important contribution to electric traction by one of the leading authorities, the method of making the batteries, their durability, recuperation of waste material, and other points considered at length..... 9983

III. ENGINEERING.—Improved Methods of Heating Railway Trains.—III. The Sewall system.—By C. POWELL KARR, C.E.—Detailed description of the system, including valves, couplings, radiators, and other elements.—9 illustrations..... 9977
Irrigating Machinery on the Pacific Coast.—By Mr. JOHN RICHARDS, of San Francisco.—Second and last installment of this valuable paper; pumps, engines and hydraulic rams discussed..... 9975
The Generation of Steam.—By GEORGE H. BABCOCK, of New York City.—Continuation of the Sibley College lecture on tubular boilers, illustrating and describing furnaces for burning bagasse, waste gas from blast furnaces, and other special applications and appliances.—7 illustrations..... 9979

IV. GEOGRAPHY.—The Yukon Region.—Facts about the interior of Alaska.—A graphic account of a trip to the interior of this comparatively unknown land.—The abundance of gold in placer deposits..... 9988

V. METEOROLOGY.—Lightning.—The action of lightning, and the effect of local objects on its direction.—Precautions to adopt to avoid its effects.—A scientific treatment of the subject..... 9989

VI. MILITARY ENGINEERING.—Pontoon Bridges.—The system of constructing these bridges as practiced by the French army corps.—13 illustrations..... 9975

VII. MISCELLANEOUS.—Improved Pneumatic Carpet Cleaner.—An ingenious machine, in which jets of air are substituted for mechanical beating.—3 illustrations..... 9987

VIII. PHOTOGRAPHY.—How to Make a Camera Bellows.—Full account, completely illustrated, of how any one can fold the material for the above purpose.—12 illustrations..... 9984

IX. PHYSICS.—A Method of Illustrating Combinations of Colors.—By H. G. MADAN.—A simple apparatus for use with the magic lantern.—1 illustration..... 9987
Physics without Apparatus.—Imitation of thunder, laws of the fall of bodies, and inertia.—Illustrated by four elegant experiments.—5 illustrations..... 9988

THE EADS SHIP RAILROAD.

We elsewhere illustrate and give the description of a recent achievement in the land transportation of war vessels. At the present time it is an event of some importance. The French nation, characterized by its enterprise in engineering and scientific fields, has executed an interesting feat. A torpedo boat was to be taken from Toulon to Cherbourg. Such vessels have proved anything but comfortable, or even safe, sea boats. Strength, seaworthiness, and accommodation, all are put aside in their construction in order to attain the highest speed. The land route, therefore, was tried, and the trial was a complete success. Without the least damage, the transportation was accomplished. The delicate sides, less than an eighth of an inch in thickness, were uninjured. The vessel rested on a simple cradle, and was taken on the regular railroad. We cite this experiment as of special interest at the present time. Less than a year ago we were called upon to note the death of James Buchanan Eads. Independent of the personal sorrow that this event occasioned, a sincere feeling of regret found origin in the fact that he had died without witnessing the successful accomplishment of his greatest project—the Tehuantepec ship railroad. By his resistless energy, which had overcome so many obstacles, natural and personal, that stood in the way of his other achievements, he had brought the work well forward. The engineering details had all been fully executed. The company had been formed, and the route selected. All that he waited for was the congressional action necessary for his enterprise, which is of international character. He died before Congress took the desired cognizance of his great plan.

All is as he left it. A new Congress has assembled. The Tehuantepec Ship Railroad Company is now in the field, ready to undertake the enterprise and still awaiting the action of the legislature. From every point of view the United States should encourage the promoters.

The plan is eminently practical. The use of marine railways for hauling vessels out of the water for repairs is old. Thousands of steamers and craft of every description are thus treated every year. Among them are the weakest kind of structures. River steamers, with their longitudinal trussing or hog-frames, ready to receive every strain, and show its effects, ascend the inclined road without injury. The devices used for cradling them are of the crudest description. No attempt is made to adopt any such improved system as that applied in the Eads plan. Thus, in the harbor of New York the daily proof of its practicability may be seen by all. For if it is possible to haul ships, with imperfect appliances, up an inclined railroad three hundred yards in length, *a fortiori* it must be easier to draw them upon a special railroad, carrying a perfected cradle, supporting the ship at every point.

The transportation of the French vessel proves it most forcibly. Here a large torpedo boat was carried on a simple cradle on ordinary railroads many miles through France. It crossed other roads and went around curves without trouble and sometimes at the rate of twenty-five miles an hour. No condition was in its favor. The vessel was of the most fragile character, and was barely seaworthy. The journey was nevertheless performed without incident, and a distance of about eight hundred and fifty miles was covered. Compared with this distance, the Tehuantepec route, about one hundred and fifty miles, seems short.

It is now considered that this method can be used for torpedo boats. The establishment of the fact, however, goes for much more than this. It proves the sound judgment of the best American and English engineers. By such the Eads railroad has been critically examined and discussed. Their opinions have been given emphatically in its favor.

A ship at sea is exposed to far more severe strains than she would ever meet on the railroad. A wave running lengthwise carries with it an upward strain of many tons, followed and preceded by downward strains of equal or greater extent. As a ship pitches and rolls, the most complicated and severe stresses are applied to her plating and frames. Longitudinal and torsional strains, the latter aggravated by her masts and ballast and general dead weight, are continually at work upon her structure. Yet all is withstood. A ship is built upon the lines of the most advantageous distribution of material. The hollow hull, with its curving contour, represents the perfection of the tubular structure. When iron ships were first proposed, one of their prominent advocates said that a properly built iron vessel could be held suspended by her bow and stem without serious flexure and without injury.

It is not too much to say that, substantially, this very thing has been done in the tubular bridges. In them a relatively light iron tube is held by its ends with its center quite unsupported. Not only does this suffice to carry its own weight, but it constitutes one of the stiffest and strongest bridges known for railroad traffic.

In situation the ship railroad has everything in its favor. It is several hundreds of miles nearer the United States than the canal routes. Its completion by an American company will place one favorite method of isthmus transit in the hands of Americans. It will compete with the canal, or canals, when they are completed. If started now, it will be finished long before either of them, and will be in successful operation, carrying ships through the semi-tropical forests, while the dredges and excavators are wearily removing countless tons of earth from the projected canal routes.

The sanction of Congress is asked, and should not be withheld. The apparent boldness of the project, coupled with its national origin, should recommend it to the legislature.

A committee of the Senate has reported in its favor. The distinguished engineer who conceived the project has left it complete and worked up to the last detail. To the fiftieth Congress is left the honor of erecting a suitable monument to the greatest engineer of his day. The Tehuantepec railroad will be his best memorial, and we cannot but believe that all desired congressional action will be freely taken.

In the transport of the French torpedo boat it is not too much to say that the far reaching influence of the American engineer is discernible. For it is highly probable that the project so successfully carried out had its original suggestion in Captain Eads' ship railroad.

A GREAT RAFT OF LUMBER.

A giant raft of timber is now expected at this port. It left Nova Scotia on December 8, in tow of the steamship Miranda. The launch took place near Port Joggis, on an inlet of the Bay of Fundy.

The leading features of its construction, which form the subject of a patent, are as follows. In general shape, it is a pointed cylindroid of elliptical section. It is composed of logs chained together, their attachment being re-enforced, and the structure consolidated by interwoven withes and small branches. Through the center a 2⅛ inch chain is carried, which is inclosed in a solid boxing. In total length, this chain is one thousand feet, leaving about four hundred feet free for anchoring or towing. The central cross section is an irregular ellipse, 65 feet wide and 39 feet deep. For four hundred feet of its central portions the sides are parallel; then they taper at bow and stern to a section 25 feet wide. This is the extent of the pointing. The total length is 585 feet. It was put together in a substantial cradle that was built in permanent shape, as it is proposed to build in it other rafts. The logs were laid longitudinally, and after each course was in place, branches and withes were laid across them, and their free ends were turned in over the next course. Every seven feet marks the point of attachment of two lateral chains that run out horizontally through the mass of logs. These connect with other chains that surround the whole mass. The latter are tightened by hydraulic jacks. The central chain, upon which the pull comes in towing, tends to still further bind together the logs, as it draws upon the surrounding bindings. The chains weigh two hundred tons.

In the center around the central cable, the hard wood is stowed, while the softer and less valuable timber forms the outer layers. It contains 25,500 sticks of timber for spars and piling, and one half a million board feet of maple, beech, and birch.

The launch was executed with great success. The great structure as it ran down the ways occupied 32 seconds in going 1,600 feet. It is estimated to weigh 11,000 tons, or 2½ times as much the Great Eastern. The lumber it contains would fill seventy schooners. If the venture proves successful, it will tend to make quite a revolution in the lumber trade.

Mr. James D. Leary, of this city, is the owner of the raft, and is a firm believer in the capabilities of the system.

PATENT "INNOCENTS" AGAIN IN CONGRESS.

A lively discussion lately took place in the United States Senate, when the Hon. J. Z. George, of Mississippi, introduced his bill (S. 787) to protect "innocent purchasers," and asked that it be referred to the Judiciary Committee, instead of to the Patent Committee, where it properly belongs.

The following is the text of the bill:

"A bill to protect innocent purchasers of patented articles, and for other purposes (S. 787).

"Be it enacted, etc., That it shall be a valid defense to any action for an infringement of any patent, or any suit or proceeding to enjoin any person from the use of a patented article, that the defendant therein, or his assignor, purchased the patented article for use or consumption, and not for sale or exchange, in good faith and in the usual course of trade, without notice that the same was covered by a patent, or without notice that the seller had no right to sell such article; and in all such cases notice received after such purchase shall not have the effect to impair in any way the right of such purchaser as absolute owner.

"Sec. 2. That all patents for any discovery or invention hereafter granted by the United States shall be subject to purchase by Congress, for the use of the people of the United States, at such reasonable valuation, and on such terms, and in such mode, as may be provided for by law; and all such patents shall be consid-

© 1887 SCIENTIFIC AMERICAN, INC.

ered and treated in law as issued subject to that condition."

Substantially the same bill has been presented to Congress for several years past, and has suffered defeat. Its object is well known, namely: Under the specious pretense of protecting innocent purchasers, it makes patented inventions, practically, free to the public.

It encourages infringers and discourages the inventor. It prevents the latter from controlling his invention. It takes from the author his right to make, use, and sell his own invention, and hands that right over to the infringer. It tends to overthrow or cripple the vast manufacturing industries that now flourish under the protection of the patent laws, and practically nullifies those laws.

Mr. George appears to have been satisfied the Patent Committee would not sanction his bill, but hoped the Judiciary Committee might do so. He said:

"As the Senator from Connecticut has stated to the Senate, that question has been before the Committee on Patents on two or three occasions, I believe, and that committee has not seen proper to grant relief—the relief which I and which a good many members of this body think the people of the United States are entitled to; and as the bill refers to the application of an important principle of law, having reference to the rights of innocent purchasers without notice, a purely judicial proceeding, as my friend from Tennessee [Mr. Harris] suggests, I thought it was proper under all these circumstances that it should go to a new committee.

"As far as I can learn, there has been more wrong and injury done under the patent laws by suits against men who go into open market, into the stores and warehouses of the country, and buy in good faith articles which they suppose the seller has a right to sell, and then are afterward brought up before a court, fifty or one hundred or two hundred miles from their homes, to account for it; and as the Patent Committee had not seen proper to extend to such cases this very salutary principle of the common law, the protection of innocent purchasers, I thought it was proper and right that another committee should consider that question also: and for that reason, and in addition to the reason which I gave first, that the Judiciary Committee was a very appropriate tribunal to determine it, I insist, in behalf of the rights of many persons in this country who have been injured by the present law, that this bill shall go to the other committee."

We think Senator George will find it difficult to produce any considerable number of examples where "innocent purchasers" have been brought up before a court fifty or one hundred or two hundred miles from their homes, as he asserts.

The existence of such wrongs we think will prove to a great extent to be imaginary. The entire amount of litigation about patents is not large. However, all who own interests in patents, as well as the public in general, are interested in knowing the full extent and nature of the injuries which the innocent infringers are suffering. The Senator will have ample time to present his evidence, and we urge him to make it as fair, strong, and complete as possible. In this way only can his legislative colleagues in the Senate and House become rightly informed and be enabled to vote intelligently. If such disastrous abuses exist as he claims, they should be rectified; and probably this can be done without nullifying the rights of patentees in the broad manner contemplated by the above bill.

The Senator's effort to have his bill sent to the Judiciary Committee was defeated by a vote of 40 to 25, by the prompt action of the Hon. O. H. Platt, of Connecticut, who objected, and in answer to Senator George said:

"As it seems to me, the Patent Committee has been in no way open to the charge of dereliction in dealing with this subject. The bill has never been before that committee, I think, but what it has received consideration and report. I do not mean this particular bill, but I mean bills embracing the same subject; and those bills so reported, if my memory serves me, have in more than one instance received the approval of the Senate. Now, why a bill bringing the same subject again before the consideration of the Senate should be taken from the committee which has heretofore had the consideration of it, as it was supposed properly, and be given to another committee, I cannot see, unless it be for the reason given by the Senator from Mississippi, that the Patent Committee have not reported upon the bill as he thinks they ought to have reported. If that principle is to be adopted in regard to the reference of measures before the Senate, as I said before, it will upset a good deal of the procedure of the Senate, and will reach a great deal further than is thought at the present time."

Senators Teller of Colorado, Chace of Rhode Island, Hoar of Massachusetts, Edmunds of Vermont, and others made remarks adverse to a reference of the bill to the Judiciary Committee.

HEKTOGRAPH ink, both purple, blue, and black: Take 1 part aniline of desired color, dissolve in about 7 parts water and add 1 part glycerine.

The Way of a Man with a Motor.

Mr. Keely, the man whose motor was to revolutionize the machinery of the world, is hardly off with the old force before he is on with the new. At a meeting of the stockholders of his company in Philadelphia, Dec. 14, Mr. Keely explained that, while experimenting with his etheric or vapor force, he has run against another form of energy, the properties of which are so captivating as to cast into shade those of his first enchantress. This new siren sings so ravishing a song that unless the stockholders follow the methods of the wily Ulysses, plug up their own ears, and lash Keely to the bottom of the boat, they will run great risk of losing that which they do not desire to lose. If their hearts vibrate in sympathy with Keely's new kinematics, they will be apt to find their pockets out of tune with their great expectations.

Mr. Keely promises nothing, but he raises high hopes by asking those who still put faith in him to open their mouths and shut their eyes and see what he will give them. As yet he has given them nothing, though they have stood with closed eyes and wide open mouths these many years. Now, Keely says that his etheric force is but a phantom which positively refuses to materialize, charm he never so wisely, but if the stockholders will only "hold on a bit," he may, he has some reason to believe, in due process of time present them with a "vibratory sympathy" which will make their eyes fairly jingle in their heads and coin jingle sympathetically in their pockets. Meantime they must take his word for it, and we really do not see what else they can do, unless they drop Keely at once, and put down to profit and loss the money they have already spent in his vaporous projects and fruitless imaginings. The company's treasury is reduced to twenty-four dollars, and by replenishing it they will be but throwing good money after bad.

As anarchists have a pleasant way of likening their case to that of John Brown, so believers in the Keely motor look upon Keely as a Palissy the Potter—a great inventor under difficulties. This is the sentimental and vagarious side of the matter, for, of course, their purpose in assisting him is to make money. They are deluded. One of the ways in which they are deluded has been pointed out by Keely himself. The stockholders had provided him with money with which to develop his etheric force, and at the late meeting Keely explained that for some time he had not been working at etheric force, but at something quite different. For people who like that sort of conduct that is the sort of conduct that such people like, but it will not pass muster with men of common sense. If it passes muster with the stockholders, that fact alone should show them that they have not common sense, and they should withdraw on general principles. Hope deferred maketh stockholders sick, unless they are willing to take all a gambler's risk, and in that case they are only gamblers, willing to play on with overwhelming probabilities against them.

The chief reason for the general opinion that the Keely motor has nothing in it is that it sounds empty, and nothing has ever come out of it, while Keely steadily refuses to let anybody look into it. This is not the method of a sincere man working honestly toward an object in which he has faith.—*N. Y. Commercial Advertiser.*

The Annual Report of the Secretary of the Navy.

The annual report of Secretary Whitney, which has just been rendered, is, in view of the large amount of attention that has been devoted to naval engineering during the past year, a peculiarly interesting and valuable document. In it the present aspect of naval attack and defense are considered at length, the secretary's views on the subject are given, and the authority for his ideas are disclosed. Much of the recent work done in the direction of building up a United States navy has been described in our columns. There would have been more to show were it not that the work is still in an incipient condition. The next twelve months will witness great progress.

Three new manufacturing branches have been established, to supply material under contract with the United States government. Plant for the manufacture of steel forgings for heavy guns, of armor plates for ironclads, and of machine and rapid-firing guns, comprise the three divisions. The new machinery of the Bethlehem Steel Works, the report states, is believed to be equal to any in the world. This is devoted to heavy forgings for guns and to armor plates. The quality of the steel is considered a distinct advance upon the best practice, and the price is within twenty-five per cent of what it would amount to were the work done abroad. The cruiser now constructing at San Francisco is alluded to in complimentary terms, not only as regards its merits, but also as a possibly important factor in developing or inaugurating a new manufacturing industry on the Pacific coast.

Of the new vessels, four are in commission; one, the Chicago, is waiting trial; ten vessels, including ships of war, cruisers, and gunboats, are building. In addition to these, the dynamite cruiser and a first class torpedo boat, the latter by the Herreshoff Co., are in process of construction or contracted for. The system of arriving at the designs for two of the fast cruisers is described. The plans for their construction were purchased abroad. But not content with these, many modifications were introduced, until the original designs have been improved beyond identification. The speed for these vessels is, under the terms of the contract, to be nineteen knots. The plan of reaching the design is summarized by the secretary as "adopting at the outset the best known methods, which native ingenuity will enable us to improve upon," thus keeping pace with the most forward.

The report speaks in dubious terms of the utility of the modern torpedo boat. Their high speed is attained at the sacrifice of protective armor, and light frames and plates have to be used for their construction. This has detracted much from their merits. The importance of the torpedo itself in modern warfare the secretary believes cannot be overestimated. But, to place these weapons, he suggests the use of partially submerged torpedo vessels, as of the Nordenfelt type, or of pneumatic projection, as in the Zalinski system. In spite of the great success of the pneumatic dynamite gun, the weapon alluded to, the report, with great conservatism, suspends final judgment. The completion of the new dynamite cruiser is waited for in order to disclose what the guns can do when afloat. If this trial should prove favorable, the report says, it would remove many doubts and difficulties. We hope that this will spur on the constructors and designers of the dynamite cruiser to renewed exertions, and will incite them to make as brilliant a success of the guns afloat as they have achieved in shore practice. The secretary admits that for shore and harbor defense its accuracy is substantially established. This refers to the trial last September, which was illustrated and described in our issue of October 1 of the present year. The trouble to be encountered in using it on ship board is the determination of the range. Owing to its high trajectory, this is an essential thing to be known to secure accurate practice. At the same time it must not be forgotten that this height of trajectory makes its range less subject to disturbance from the pitching of the ship, and that, as a target, it has the length of a ship instead of its height.

A very interesting portion of the report deals with the establishment of a naval reserve, a sort of marine militia. Some arrangements, it states, should be made for the mobilization of merchant steamers in war, and the government should exercise due oversight over the construction of new vessels, to see that they are in general adapted to use as transports or in other war service.

The subject of monitors and of the construction of provisional vessels of inferior type is treated. The report is in opposition to both. Monitors it considers antiquated, and no longer serviceable vessels, even for defense. It recommends that all appropriations be spent in producing the best attainable ships, and opposes the diversion of money from this end. Authority is asked, in furtherance of these views, for the construction of three more fast cruisers of the highest type. In six years more, the chief of construction states that but four serviceable cruisers will be left in the navy of this country, so that the recommendation would seem well established.

The general tenor of the report indicates progressive ideas and a readiness to examine all new suggestions. In view of this disposition, it seems curious that but three finished torpedoes were presented to the Torpedo Board by the inventors. A new navy is now in process of creation. This is the time for the inventor to do his most patriotic work in devoting his talents to the protection of our shores from possible invaders and bringing the inventive genius of America again before the world in a hitherto somewhat neglected department.

Flight of Young Homing Pigeons.

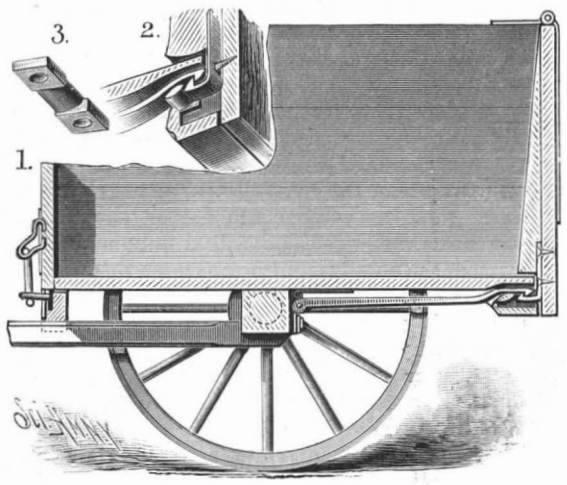
Eighteen birds owned by C. O. Barrett, Dorchester, Mass., were liberated in Forest, Lambton County, Ont., at 6:34 A. M., on Tuesday, October 25. The first return was Leslie P. (H. 237), which arrived in the home loft at 4 o'clock Thursday afternoon. The air line distance covered is 540 miles, the most remote point from which a bird of the year has ever returned. The record to be beaten was made a year ago, from London, Ontario, to the Wagner loft, Boston; distance, 525 miles, the first bird returning on the morning of the second day after the start. This journey gives the Barrett loft the record for every distance of the season, winning for it all the special prizes open to all, including the Hudson badge. The record is not only good for distance, but it is the second best of the year for any age from over 500 miles, and the best from over 510. The best from 500 or over was made by the bird Staunton to the loft of George Darby, of Boston.

AT Balakhan, near Baku, Russia, a new petroleum spring, which rose 150 yards, flooded the country, impregnating everything. Nobody ventures to light a fire, for fear the town will go off like fireworks.

© 1887 SCIENTIFIC AMERICAN, INC.

AN IMPROVED DUMP CART.

A cart so constructed that the tail gate may be automatically opened, or shut and locked, by inclining the body from the front or bringing it to a horizontal position, is illustrated herewith, and has been patented by Mr. John G. Frogner. Fig. 1 shows a central longitudinal vertical section of a cart so constructed, Fig. 2 being an enlarged view of the rear section. The tail gate, hinged at the top, completely covers the end of the body, and also the face of a transverse strip attached to the body on the under side, flush with the end. The strip has a central slot registering with a similar slot in the bottom of the wagon body, and between the body bottom and the transverse strip is fixed a metal bridge plate with a central reduced beveled portion, as shown in Fig. 3. This plate is adapted to



FROGNER'S DUMP CART.

span the registering slots. To the center of the rear face of the axle a plate is adjustably secured, by a screw bolt and washer, and to the upper end of this plate a rod is hinged extending to the rear and into the recess to a bearing upon the bridge plate, the rod having at its extremity a hook facing downward. Upon the inner face of the tail gate is a vertical central wedge-shaped brace, its base resting upon the bottom of the cart when the tail gate is closed, and behind this brace, at the base, the shank of a hook is attached to the inner face of the tail gate. When the cart body is held horizontally the gate automatically closes, and the hook upon the gate engages the hook upon the rod hinged to the plate upon the axle. When the front of the body is raised so as to carry it at an angle to the axle, the offset portion of the hinged rod passes over the bridge plate, whereby the hooks are disengaged and the tail gate is automatically opened.

For further information relative to this patent address Messrs. J. & C. Wipf, Iola, Wis.

THE TRANSPORTATION OF WAR VESSELS BY RAILWAY.

It is of the greatest importance to the navy to be able to transport ships rapidly from one port to another. The distance by sea from Toulon to Cherbourg is very great, especially for small vessels like torpedo boats, which cannot easily withstand heavy seas and would run the risk of finding ports closed against them. At first it was proposed to shorten the route by making use of canals. This expedient was tried two years ago, and was voted a failure. It was necessary to dismantle a torpedo boat to such an extent that on arriving at its destination it had to be put on the stocks. The great diameter of the propellers of torpedo boats rendered it necessary to locate the shaft in the keel; and to protect the propeller, and sustain the rudder, it was necessary to terminate the stern post with a stock which extended far beyond the keel.

That the boat might pass through the canals it was necessary to remove this, which, when remounted, was never as solid as when it was in one piece with the stern post.

Furthermore, the passage of the boat interrupted the traffic on the canal, and some of the locks were not sufficiently long to admit of the passage of the vessel. In a word, the disadvantages were so many that it became necessary to abandon this system of transit.

Railroad transportation naturally suggested itself. The question was made a study by a member of the engineering corps of bridges and highways, and the minister of the navy decided to make the experiment on the proposition as submitted to him, and ordered the work to be commenced for making the experiment.

The making of the trucks designed by the projector was carried out by the engineers of the Company of Creusot, and the trial was entirely successful.

The vessel, placed, like enormous trunks of trees, on cradles on two trucks, projected 44 feet beyond the same in front and 33 feet behind. There was some fear that the weight of the sections which overhung without support would cause damage to a hull whose thickness was only 3 millimeters. There was no indication, however, of any such result. The vessel arrived at the end of its journey of 847 miles between Toulon and Cherbourg in a perfect condition. The trial proved: 1st, that vessels larger than that experimented with could be transported on railways; 2d, that a torpedo boat could be docked at Toulon and could leave by train 24 hours afterward, arriving at Cherbourg in four days and three nights, and could be ready for service 24 hours afterward.

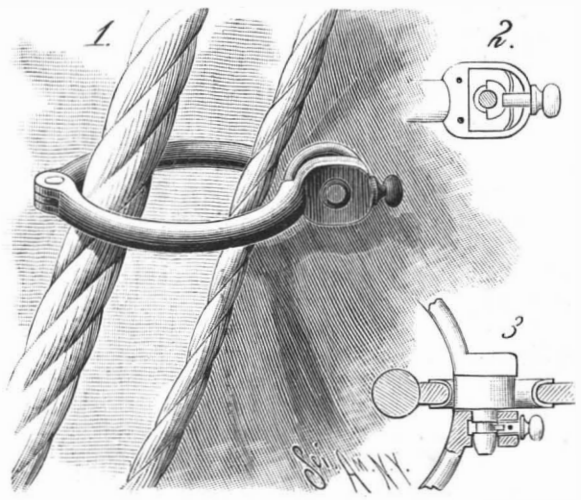
Torpedo boat No. 71 was the one selected for trial. It weighed 38 tons without its supply of water and coal and without its equipment and baggage. It is 111 feet long, 11 feet in width, and 9 feet in height. All parts that were not integral with it were removed and placed in cars.

The vessel was lifted out of the water by a hydraulic crane of 160 tons, and placed on two trucks that were provided with two movable cradles that were mounted so as to turn on a central pivot. These trucks have three axles, about seven feet apart, and the end axle has the Recour bearing, which enables it to turn, and facilitates it in making a curve of 375 feet radius.

The body bolster consists of a frame secured to the body of the truck by a main bolt, and rests on four spherical bearings, which in turn rest on guides. The sleepers possess sufficient play to enable the frame to rotate sufficiently on the main bolt to round the smallest curves on the road. The two trucks are placed next one another in close connection, so that the distance between the pivots does not exceed 27 feet. The weight of the vessel, and the fact that the keel remains parallel with a line passing through the centers of the two trucks, the point of the vessel corresponding with the middle of the line, departs necessarily from the axis of the road. It is necessary, therefore, to reduce the distance between the trucks to facilitate the passage of bridges and tunnels. The height of the vessel is limited by the lowness of the bridges. To lower the cradles as much as possible, the two supports are sunk between the wheels.

The stock at the end of the stern post juts out nearly 3 feet beyond the keel, and requires a special car, which allows the freedom of movement required by the rounding of the curves. The space between the side of the car and the hull of a vessel of 111 feet is sufficient to allow a longitudinal play of about 2 feet, which allows for the action of the connecting links and buffers, and a lateral play sufficient for a curve of 375 feet radius. A long link keeps the last truck at a distance of 12 feet.

The boat occupies the space of about five cars of ordinary size. In front of the cars of special construction are two cars without sides. In one of the first cars were one of the engineers of bridges and highways and Mr. Baehme, commander of the torpedo boat, who observed and were prepared for anything unexpected that might occur. In front and behind the boat were cars carrying the accessories. The train made about 16



JAMESON'S JIB HANK.

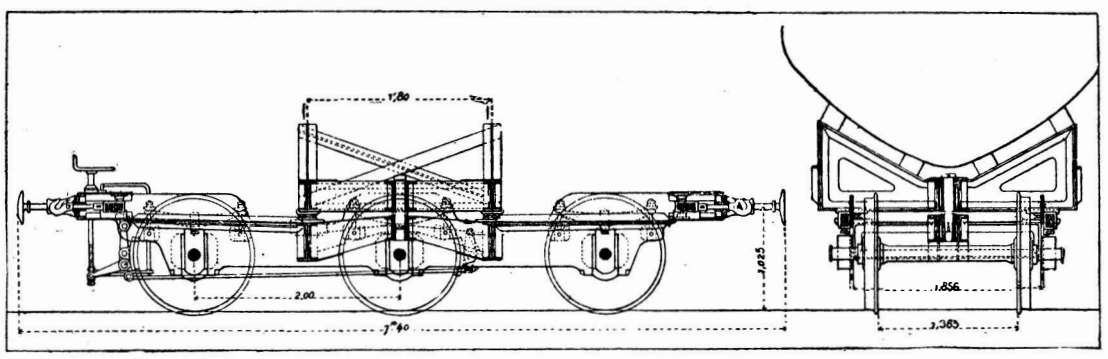
miles an hour, a speed which was increased for the sake of experiment to 24 miles.

The expense of preparing the wagons amounted to 32,000 francs, being 13,000 for the two wagons carrying the cradles, and 6,000 francs for the special car. The railroad company charged 0 fr. 25 cent. per ton for transportation, and the weight being 40 tons made the total expense of transit from Toulon to Cherbourg 13,650 francs. The price was high because of its being a special train, and a long, indivisible one. This expense could be considerably reduced by making special rates. Three or four torpedo boats could be transported in one train without exceeding the regulation length of train, or two trains could follow one another ten minutes apart.

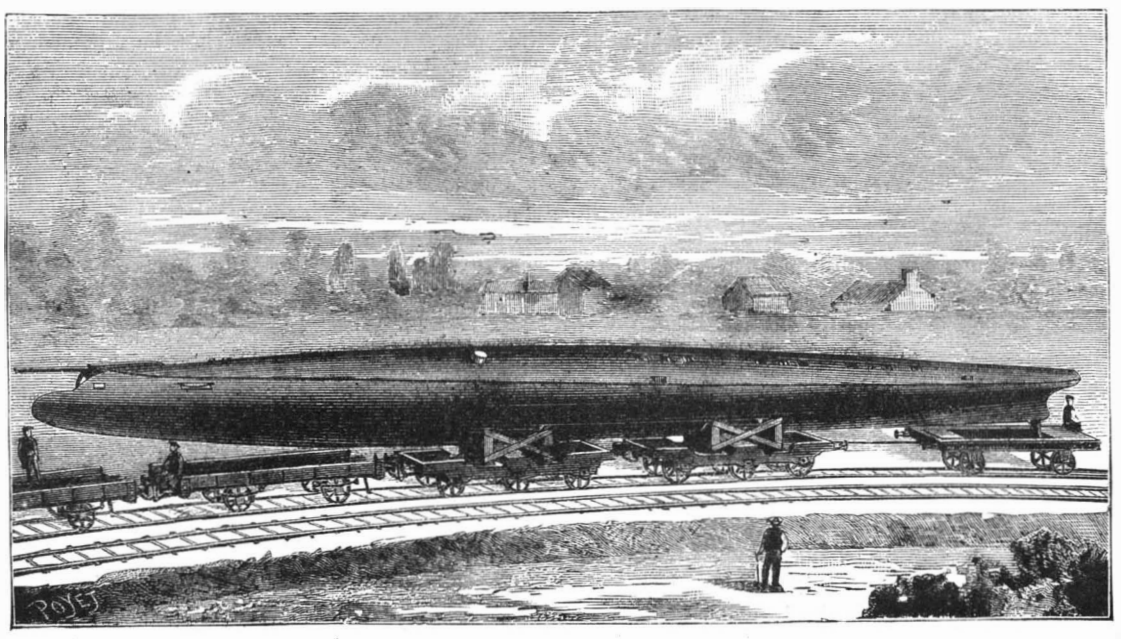
In case of war with England, for example, and it was necessary to transport torpedo boats from Toulon to Cherbourg, the expense for material would not exceed 300,000 francs, and the transportation would be within 80,000 francs

These expenses are very light, and especially so when it is remembered that the expense for material would not be necessary after the first trip, and that the other advantages are very great.

At the request of the ministry, the railroad companies ought to establish favorable rates and decide the maximum size of vessels that would be received. The trial was a complete success, thanks to the wisdom and ability of the engineers who made a study of the problem. There is no doubt that the navy will take advantage of the results of the experiment. —*La Nature.*



RAILWAY TRUCK FOR TRANSPORTING WAR VESSELS.



TRANSPORTATION OF WAR VESSELS BY RAILWAY IN FRANCE.

AN IMPROVED JIB HANK.

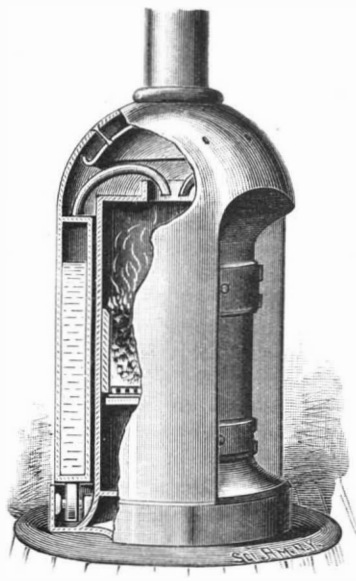
A device to facilitate attaching and detaching jibs to and from their stays, and which is simply made, conveniently applied, and reliable in use, is illustrated herewith, and has been patented by Mr. Thomas O'Rourke Jameson, of No. 414 Smith Street, South Brooklyn, N. Y.

The hank is made in two semi-annular parts, hinged to each other at one end in such a way that the hinged part will have a smooth inner surface to slide along the stay. Upon the free ends of the hank sections are disks designed to cover the eyelets in the sail, and integral with one of the disks is a pin which passes through the sail eye and into an aperture in the opposing disk. The pin has an annular shoulder to limit the approach of the contiguous faces of the disks to the eyelets, and an annular

© 1887 SCIENTIFIC AMERICAN, INC.

groove near its reduced outer end, the disk receiving the end of the pin having a central recess, within which is a dog held by a shank passing out from the disk and having a knob, as shown in section in Figs. 2 and 3.

A spring bearing against the end walls of the recess retains the dog in position. The hank having been passed around the stay, and the pin entered the aperture of the second disk, the spring-actuated dog drops into the pin groove and constitutes a lock, the fastening being readily released by pulling on the knob.



CUTHBERT'S CAR HEATER.

AN IMPROVED SAFETY CAR HEATER.

A car-heating furnace, surrounded by a water tank mounted on wheels and adapted to revolve around the heater, is illustrated herewith, and has been patented by Mr. Robert B. Cuthbert, of Ten Mile Hill, S. C. The heater has the usual fireplace, ash pit, and door, and is mounted on a circular base, in the outside of which, on suitable brackets, are mounted wheels which support a tank surrounding the heater, with the exception of the front, the tank being filled with water or other fire-extinguishing fluid. To the upper end of the tank are secured upwardly and inwardly bent pipes, opening at their free ends into the top opening of the heater, and on the top is a dome-shaped shell with a smoke outlet, the interior of the top being protected by a spherical fire guard or deflector, preventing the smoke from passing directly upward, but causing it to travel under the lower edges of the deflector, and thence to the outer opening at the top. When the car meets with an accident whereby the heater and tank are upset, the fire-extinguishing fluid will flow by the pipes into the fire-box or on the burning fuel that may escape.

AN IMPROVED GATE.

A firmly constructed and inexpensive gate, designed principally for use with fences for lands, and which is so made that any tendency to sag can always be readily corrected, is shown in the accompanying illustration, and is covered by two patents granted to Mr. John B. Holton, of Washington, Ky. Between the uprights are stretched a series of longitudinally ranging stay rods, which have heads at one end and screw-threaded bolt ends and nuts at the other end, these rods passing through a diagonal brace of the gate, and also through a vertically ranging metal stay bar. The tops of the uprights, which project above the top rail, are connected by a truss rod, which passes through a hole or slot in the top of an angular metal plate held to the top gate rail partly by the same bolt which holds the diagonal brace to this rail. This angular plate is also held firmly by a nut which locks thereon the end of the vertical stay bar. A brace rod also extends from the hinge upright to the diagonal brace, and has adjusted nuts on its rear end. With this construction there is very little liability of disjointing the gate, either laterally or vertically, and the tendency of the gate to sag is reduced to a minimum. Fig. 2 shows the gate frame, from which the longitudinal stay rods and the base board are omitted, and also illustrates the construction

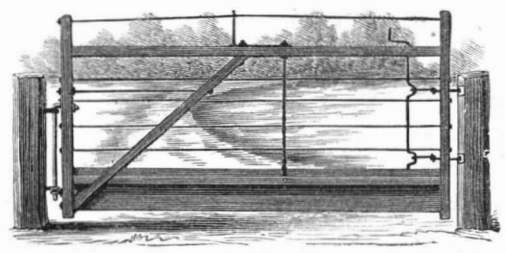
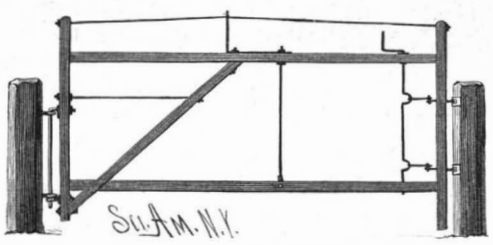


FIG. 1.



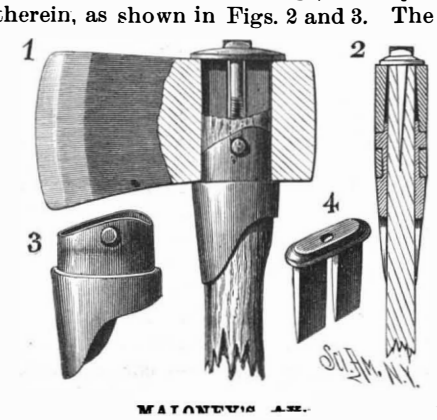
HOLTON'S GATE.

and application of the hinge and latch. The hinge is a right-angular rod, with its longer arm passing down through two open eye bolts set in vertical alignment in the post, and its shorter arm passing through the hinge upright of the gate. This shorter arm of the hinge, being screw-threaded, combines with a screw plate thereon, which in position rests against the outer face of the upright, and through its upper end, just above the hinge rod, passes the brace rod of the gate. A nut is screwed on the end of the short arm of the hinge, which projects through the upright. The lower end of the long arm of the hinge rod enters the eye of a screw-threaded eye bolt, which passes through the hinge upright, and has two nuts applied to it on the respective sides of said upright. Any tendency of the gate to sag can always be readily corrected by the adjustment of the nuts on this bolt, and also by adjustment of the screw-plate and nut on the horizontal or shorter arm of the hinge rod, and the adjustment of the nuts on the outer end of the brace rod. The gate latch comprises a couple of bolts fitted to slide horizontally, within metal cups or bushings, in the outer upright, the bolts having springs to force them outward, and their inner ends being connected by links or chains with cranks formed as bends of a latch-operating bar journaled to the top and bottom rails of the gate. A double-inclined catch plate is fixed by bolts or screws to the latch post.

AN IMPROVEMENT IN ATTACHING AX HELVES.

An invention providing means whereby the helve may be quickly and readily attached to and detached from an ax, and the ax be greatly strengthened, is illustrated herewith, and has been patented by Mr. Calvin Maloney, of Lower Lake, Lake County, Cal.

The ax is made with aligning apertures in its sides, from the eye, as shown in Fig. 1, and a socket of malleable iron, with shoulder and lugs, is adapted to be fitted therein, as shown in Figs. 2 and 3. The helve is



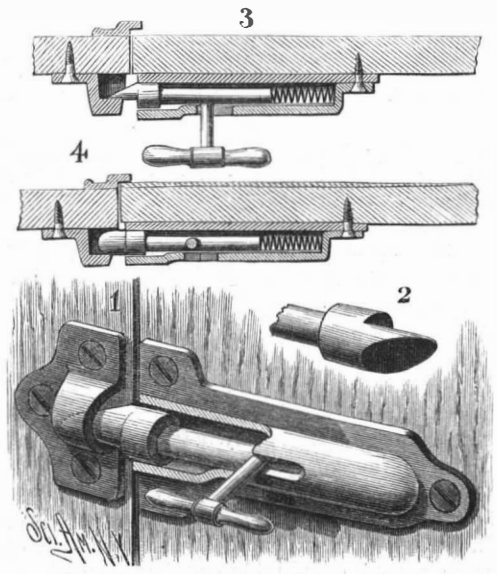
MALONEY'S AX.

then inserted in the eye in the ordinary manner, the outer portion of the socket encircling the helve immediately below the ax, at the weakest point.

In a vertical wedge-shaped slot at the top of the helve is inserted a centrally divided wedge, Fig. 4, and into a central aperture of this wedge is passed a screw, whereby the wedge is firmly fixed to hold the ax upon the helve, and by unscrewing which the wedge may be readily taken out and the ax detached from its helve.

AN IMPROVED DOOR BOLT.

A door bolt especially applicable to refrigerator, ice-house, and similar doors, where it is desirable to close the doors very tightly, is shown herewith, and has been patented by Mr. Frank T. Cladek, of Rahway, N. J. The casing holds a coiled spring to constantly press the bolt forward, the handle of which projects through an opening with side notches to permit the turning of the handle up or down, for locking the bolt in the keeper, and for turning the head of the bolt, shown in

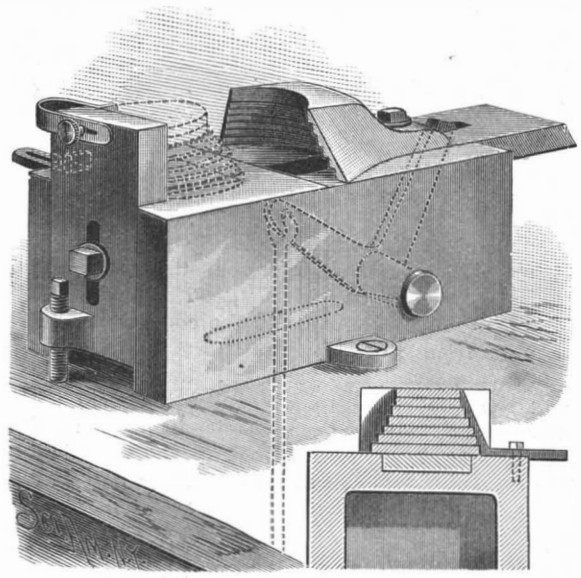


CLADEK'S DOOR BOLT.

Fig. 2, so that it will exert a cam action in the keeper for closing the door tightly. When the handle stands at right angles to the door, as shown in Figs. 1 and 3, the flat surface on one side of the extremity of the bolt will face outward, and in this position will hold the door and door frame flush with each other; but when the handle is turned up or down, as shown in Fig. 4, the cylindrical portion of the bolt will press the door inward tightly against the door jamb.

A MACHINE FOR FORMING BOOT OR SHOE HEELS.

A machine with which a boot or shoe heel may be quickly built to nearly the desired shape, and which is designed to be operated by an inexperienced workman, is represented in the accompanying illustration, and has been patented by Mr. Edgar Jones, of No. 383 Hamilton Street, Albany, N. Y. A perpendicular plate slides vertically in a groove in one end of the base, the

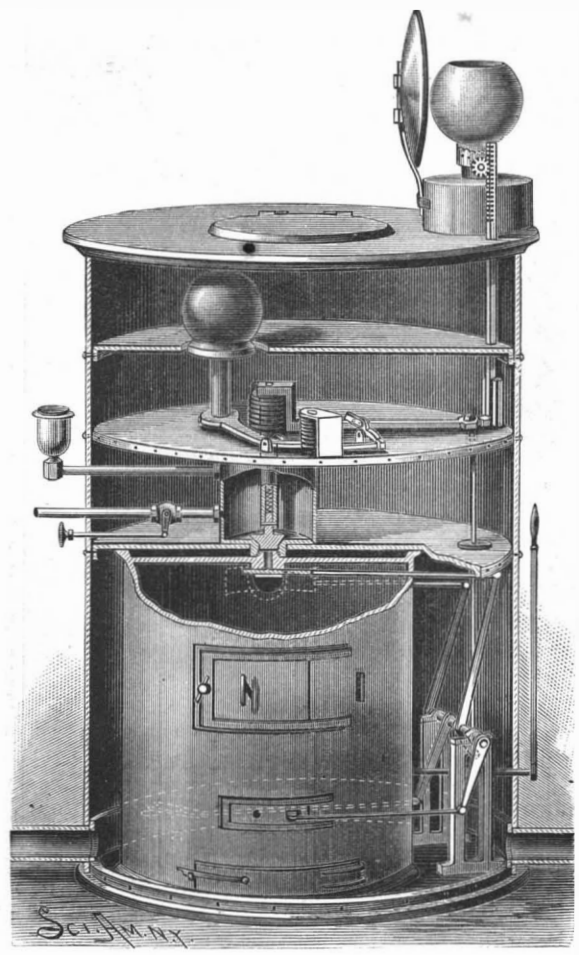


JONES' BOOT OR SHOE HEEL FORMER.

plate being adjustable by a screw at such height as desired, a gauge being attached to one edge of this end sliding plate to constitute a guide for the upper lifts, and another gauge being provided in the upper surface of the table as a guide in placing the lower lifts. Each gauge is slotted and held by a set screw to be readily adjustable to different sized lifts. In ways upon the upper longitudinal edges of the base slides a plate adapted to carry upon its forward part a die or former, the plate being moved forward by a treadle, and a separate die or former being used for different styles of heels. The lifts are placed in position one upon another, as shown in dotted lines, their front surfaces bearing against the end plate, when the die or former is brought firmly against them and the several lifts held in a fixed position until they are nailed.

AN IMPROVED FIREPROOF CAR HEATER.

A car heater which is designed, in case of accident, to extinguish the fire in the heater and the lights in the car, to shut off draught and prevent the escape of smoke and hot air, is illustrated herewith, and has been patented by Mr. Jerod Tyler, of St. Mary's, Pa. The casing is made of strong boiler iron, in which the furnace is braced with light curved braces, which, with the transverse plates, are designed to give the heater fully the strength of a locomotive boiler. The casing has three horizontal partitions, besides the top plate, and the partition which rests on the top of the heater proper supports a fuel-extinguishing device, with a vessel to contain an extinguishing fluid, and



TYLER'S CAR HEATER.

© 1887 SCIENTIFIC AMERICAN, INC.

having an aperture leading to the interior of the heater. A rod passing through the top of this vessel, and above the next partition, has on its upper part a coiled spring which presses against an arm actuating a lever which extends upward through the next partition, carrying in its upper end a cup supporting a heavy ball. Another arm of this lever is connected with a rod which turns the wick rod, to extinguish the light in the lamp or lamps connected therewith, and other connections provide for closing the heat apertures, shutting off the draught and closing the smoke flue, and opening the valve by which the fire-extinguishing fluid is permitted to fall through into the interior of the heater. This action is only set in motion by a shock of sufficient severity to displace the heavy ball which rests in the cup above the upper partition.

Spectacles for Horses.

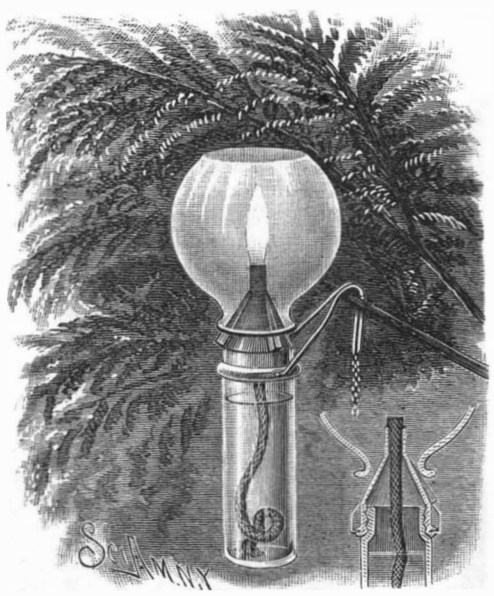
A correspondent of the Manchester *Sporting Chronicle* tells the readers of that paper some interesting circumstances in connection with a "good grey steed in his own possession." He came to the conclusion that this equine friend of his was short-sighted. He "couldn't see a carrot two yards off," he tells us. So he took the quadruped to an oculist living in the neighborhood, who made the necessary inspection and certified that the horse had a No. 7 eye, and required concave glasses. The concave glasses thus indicated were obtained and buckled on to the head stall. "The horse seemed a little bit surprised," he says, "when I first put them on him, but his amazement rapidly gave way to demonstrations of the keenest pleasure. He now stands all the morning looking over the half-door of his stable with his spectacles on, gazing around him with an air of sedate enjoyment. . . . When I take him out for a drive," continues the veracious narrator, "he capers about as frisky as a kitten; his manner is altogether changed from his former timidity, and he has got over a bad habit of shying which once troubled him." A week or two ago, however, he turned the animal out to pasture for a few days, of course without his specs, and he at once appeared to be uneasy and uncomfortable. All day he hung about the gate leading into the meadow, whinnying in a plaintive minor key, until his master, seeing what was the trouble, sent up to the stable for the head stall. As soon as the spectacles were placed upon his nose, he was so glad that he rubbed his master's shoulder with his nose, then kicked up his heels and danced down to the pasture in a paroxysm of delight. Staffordshire was the scene of this history. We do not know the locality more definitely.

Articles found in an Etruscan Tomb.

A fine glass vase, just discovered in an Etruscan tomb at Bologna, is of a sea-green color, like a soda water bottle, thick and of a unique form, with two handles. It is nine inches high and without ornamentation. There is not a single defect, flaw, crack, or chip about it. With it was found an ivory chair, made after the fashion of a modern camp stool, having all its screws and rivets still in perfect condition, and a small casket containing beads and some very elegant articles in bronze. The articles are supposed to date from the fifth century. The tomb in which they were found was closed at the top by an enormous globular mass of stone as fresh as if it had only been fashioned yesterday.

A LAMP FOR CHRISTMAS TREES.

A candle-like lamp, with special means for its suspension and attachment, applicable to various decorating and illuminating purposes, and particularly designed to take the place of candles on Christmas trees in churches, schools, etc., is represented herewith, and has been patented by Mr. John H. Barth, of No. 612 East Market Street, Louisville, Ky. The body may be a simple glass vial having an exterior screw thread on its neck, while the burner is conical, made in a single piece, with a central wick passage, a suspension wire

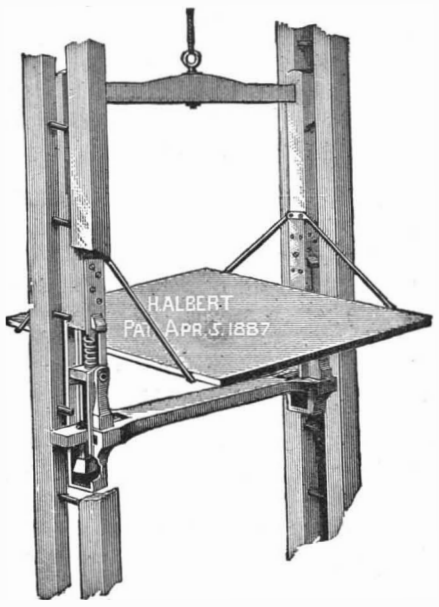


BARTH'S CHRISTMAS-TREE LAMP.

formed with a hook being pivotally connected at its ends to opposite sides of the burner. The burner has exterior tapering ridges over which may be slipped, and which will securely hold, a globe, the spaces between the ridges or ribs serving to supply air to the wick. The hook provides for readily hanging the lamp as desired, and, in connection with the suspension wire, the lamp may be secured in any position almost instantaneously.

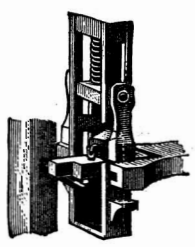
AUTOMATIC SAFETY ELEVATOR.

The vertical side sections of the elevator car travel in guides consisting of twin vertical uprights, built into the wall on each side of the elevator shaft. These guides are provided with pins or bars arranged within the guides at regular intervals. The side sections of the frame slide up and down within the guides, and are connected with one another by a horizontal cross section, which carries at its extremities the safety catches. This catch is under the car, and is a lever pivoted at the center and so arranged as to strike freely the bars within the guides. It is brought back to its horizontal position by a small weight. This lever strikes the rack bars successively, but is simply swung out of the way and performs no function. If, however, the descent becomes too rapid, the lever bar is thrown over a half revolution, and the other end of the lever comes in contact with the rack pin between the guides, and as the pivoted bar can only make a half revolution, it serves as a stop and prevents further descent of the car.



AUTOMATIC SAFETY CATCH FOR ELEVATORS.

By the same movement the weight, which is hung to the bottom of the swinging bar, is thrown over and prevents the same from rebounding before it is caught upon the rack bar. There is very little jar, as the shock is taken up by springs, which are mounted in the frame between the safety catch and the car body. The large engraving represents the catch in its normal position,



and the small cut shows it in position to stop the car. In order to return the stops to their normal position, it is only necessary to raise the cage until the first bar of the rack above is reached, which turns over the lever and permits the cage to descend. Since the catch is arranged under the cage, the operation of the safety appliance is not dependent upon the hoisting rope, machinery, nor dogs, nor cam, but simply on its own action, so that when the movement is too fast the stops turn over and the cage is arrested.

This device has been patented by Mr. Henry Albert, of Crescent City, California.

Manchester Mill Operatives.

The Saint James's Budget of November 19 says:

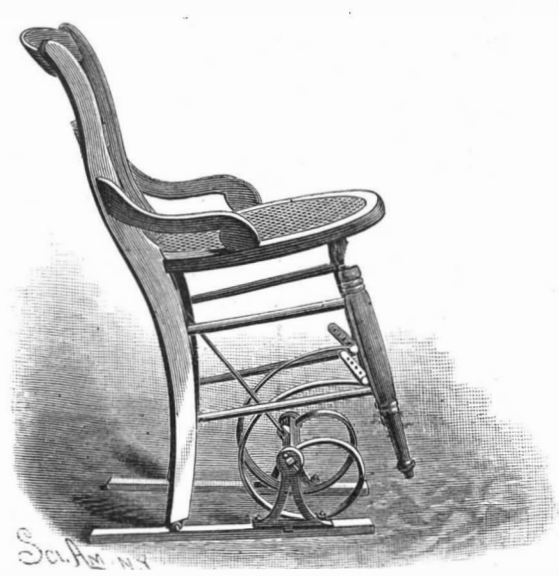
"There have been fewer spindles running this year in Manchester than at any time since the cotton famine, and the published balance sheets of the joint stock spinning companies show scarcely a margin of profit where they do not show a loss. It can hardly be said that private firms have fared any better. Of course for this melancholy state of affairs foreign competition is largely accountable. Concurrently with the decay of prosperity, we note the decline in character and physique. The graybeards who made Lancashire rich and famous were reared on porridge and potato pie, and are robust old men, hard-headed, upright, open-handed, adventurous, and not over-educated. The sons are weaker both in physique and character. Among the operatives the deterioration is still more marked. The mill operative is stunted, pale and pinched, restless and irritable, and generally has some disorder of the digestive organs. Nature may have given to his dwelling place green bank and field and tree and flower, but factories and chemical works have made its fields into cinder wastes, its streams into sewers, and have killed with their poisonous exhalations both flower and tree. He earns the wages of a skilled artisan, but the trick of his occupation learned, he is a mere attendant on a machine of which he knows little or nothing. He leads a weary, poisoned life, and his womankind are like himself. They work with him in the mill, and are stinted and pinched. Next to the women of the collieries, they are the most unwomanlike of their sex—as flat and narrow of figure as the men, and it is understood by some, who are not very sorry for it, that they find it difficult to become mothers. Large families are rare. It really seems as if in the fifty years of driving work and industrial ascendency, Lancashire has almost spent the pith of her people. But if we are ever threatened with civil strife, and if Lancashire has sunk meanwhile into deeper poverty than now, her mill operatives will be the most dangerous of revolutionaries."—*John Fretwell.*

Electric Street Cars.

In a recent issue our Berlin correspondent gave a description of the new electric tram car tried on the Cologne railways by Messrs. Herbrand & Co., of Ehrenfeld. The whole electrical installation on this car has been designed by Mr. Huber, of Hamburg, who had two cars on the same system running in that town from the 1st of May to the 25th of December, 1886, but which were withdrawn at that date, as it was found that they were not sufficiently powerful to overcome the resistance of the track when the groove in the rails was filled with snow or ice. We have received a letter from Mr. Huber referring to the question as to what power should be provided for electrically propelled cars, and as he has had a large experience in this subject, his figures will probably be of interest to our readers. Mr. Huber estimates that on an average road, with gradients not exceeding 25 per 1,000, the energy which must be stored in the cells is 7·6 watt hours for every 100 kilo of rolling load moved a distance of one kilometer. Reduced to English measure, this works out to 125 watt hours per ton mile. Allowing an efficiency of 80 per cent from the indicated power of the engine to the electric output of the dynamo, we require 0·21 i. h. p. hours for every ton mile. Thus in a tram service employing fifteen cars, each weighing 8 tons when full, and where every car runs 70 miles, the daily charging power required would be 1,760 i. h. p. hours. If the time of charging is 15 hours daily, steam power to the amount of 117 i. h. p. would have to be provided. The power naturally varies with the condition of the road. In warm, rainy weather, less than the amount here given will be required; but when the road is clogged with dirt, ice, or snow, something more should be allowed.—*Industries.*

IMPROVED ROCKER FOR ORDINARY CHAIRS.

A simple, efficient, and adjustable rocker, adapted for use with ordinary chairs, is represented herewith, and has been patented by Mr. Daniel Smith, of Santa Rosa, Sonoma County, Cal. It consists of a base frame having sockets to receive the rear legs of a chair, with springs supported at one end by standards fixed to the base frame, the other ends of the springs being secured to the front legs of the chair. These springs can be placed on any common chair, to make a rocker of it, and, being placed under the chair, are entirely out of the way of the feet or ladies' dresses, the springs giving an easy rocking motion under the tension which comes on them with a person sitting in the chair, and preventing any excessive movement either forward or backward.



SMITH'S ROCKER FOR CHAIRS.

SUBSCRIBE for the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT for 1888—$7 a year for both papers—and you will surely have all the latest and best scientific, mechanical, and engineering news of the day from every part of the globe. Subscribe now for one or both.

© 1887 SCIENTIFIC AMERICAN, INC.

Correspondence.

Grindelia Spirosa.

To the Editor of the Scientific American:

It may be of interest to your botanical readers to know that, while collecting plants, early in last September, I found a specimen of *Grindelia spirosa.* It was in rich soil, about five hundred feet from the shore of our lake (Michigan).

Since it belongs to Rocky Mountain botany, and has a habitat not farther east than Colorado, it would be interesting to know how it found its way to our town.

It could scarcely have been brought by the railroad, fo it was fully half a mile from any track.

Since finding the "*spirosa,*" I have been informed that another species has been found in Michigan. Perhaps you can offer an explanation of how it was likely to be brought here, or your correspondents may be able to give instances of finding some other *Grindelia.*

WM. H. DUNHAM.

No. 721 Greenwood Street, Evanston, Ill.

The Rock Salt Find at Ellsworth, Kansas.

To the Editor of the Scientific American:

A paragraph copied from your columns has been apparently going the rounds of the press. I have seen it in two Kansas papers. It is to the effect that recent discoveries of rock salt at Ellsworth, in this State, were made by prospecting parties against the advice of professional geologists, who assured the parties that they would get only their labor for their pains. This statement is altogether incorrect. The discovery of rock salt was predicted twenty years ago by Professor Mudge. The present writer only a few months before the Ellsworth discoveries assured citizens of Ellsworth County that salt as strong brine or rock was one of the certainties to be found by deep drilling in almost any part of Kansas. Warnings against the expectation of finding coal by deep drilling in middle and western Kansas have been given by geologists, and every boring made has justified the warning. The present writer, in the last biennial report of the State board of agriculture, has suggested that rock gas may be found in those regions. The drillings made have mostly yielded it, but so far not in any large quantity. As far as Ellsworth is concerned, it is not believed that any expert geologist was consulted, as there are only two or three in the State. To put the professors of science right on this matter, will you insert this?

ROBERT HAY, Geologist.

Junction City, Kansas, December 7, 1887.

The Uncertainty of the Law—The Driven Well Case.

It would be hard to find in the history of litigation a more striking instance of the uncertainty of the law than the driven well case recently decided by the Supreme Court of the United States. The patent was granted January 14, 1868, and reissued May 9, 1871. It expired January 14, 1885. The litigation concerning the invention began in the Patent Office, in an interference proceeding before the letters patent were issued, and it survived the patent nearly three years, ending only with this last decision of the Supreme Court, if that shall in fact finally end it.

The act of 1836, entitled "An act to promote the progress of the useful arts, and to repeal all acts and parts of acts heretofore made for that purpose," did not allow a patent for any invention which had been in public use, or on sale, *with the consent or allowance of the inventor*, for any period, however short, before his application.

An amendment to this act, passed in 1839, provided that every person who had purchased a new invention before the application should have the right to use and sell it, and that "no patent shall be held to be invalid by reason of such purchase, sale, or use, prior to the application for a patent as aforesaid, except on proof of abandonment of such invention to the public, or that such purchase, sale, or prior use has been for more than two years prior to such application for a patent."

The whole case turned upon the question whether, under this amendment, the public use for more than two years must be with the consent or allowance of the inventor, in order to invalidate the patent, or whether any public use of it for more than two years, though without the inventor's knowledge, would have the like effect.

The Supreme Court held the latter, and declared that "the purpose of the section was to fix a period of limitation which should be certain, and require only a calculation of time, and should not depend upon the uncertain question of whether the applicant had consented to or allowed the sale or use. Its object was to require the inventor to see to it that he filed his application within two years from the completion of his invention, so as to cut off all question of the defeat of his patent by a use or sale of it by others more than two years prior to his application, and thus leave open only the question of priority of invention."

There has never been any controversy as to the facts to which the construction of this statute was to be applied in relation to the driven well patent. It was proved in the interference case, before the patent was granted, that Col. Green invented the driven well process in 1861, and put one in operation in Cortland, N. Y., while he was drilling his regiment there, and that during the next three years, and more than two years before he made his application for a patent, several driven wells were constructed in that town and publicly used. Col. Green denied all knowledge of these wells, and excused his delay in making the application by proof of his troubles arising out of his indictment for shooting one of his officers, and his discharge from the army.

During the litigation concerning this patent for nearly twenty years, the Patent Office, five circuit judges, and three justices of the Supreme Court had concurred in a construction of this statute which required the knowledge and allowance by the inventor of more than two years' use of his invention, to defeat his patent. In fact, it had come to be regarded as settled law; so much so, that Walker in his recent work on patents stated that under the law of 1839, "the consent of the inventor was a necessary element of the facts upon which the old law raised a constructive abandonment;" that this was changed by the act of 1870; and that "the old law on the subject of consent can still be invoked on behalf of any patent granted before the approval of the act of July 8, 1870." This only followed the views expressed in Curtis on Patents, which was published and regarded as authority long before this patent was issued.

It was solely by the overthrow of this construction of the statute, which seemed to have become so firmly settled, that the Supreme Court reached the result of invalidating this patent. It seems a hard fate for the acknowledged inventor of a process of world-wide utility that he could not have been told by the patent offices or the courts, at the outset of his efforts, what was the right construction of this act of Congress. And it seems doubly hard that he should have been led by repeated decisions of the federal courts to rest upon their wrong construction of the act, and to spend vast sums of money, and involve the interests of others, in maintaining his character as the inventor of a thing which could not, as it now turns out, be lawfully patented, and in defending a patent which, on the admitted facts, shown in the interference case, ought never to have been granted.

It was, however, no fault of the Supreme Court, for it happened that in the three cases decided by that court the fact that driven wells had been constructed in Cortland more than two years before the application did not appear, and the construction of the act of 1839 did not become a subject of controversy. In fact, until Judge Love, in the Hovey case, read his able opinion declaring the view of the section now sustained by the Supreme Court, the contrary view had been regarded by the circuit courts and the profession as definitely settled.

The remark with which this article opened is, therefore, justified by the facts. This driven well case is a signal instance of the uncertainty of the law.

To sum up the situation: Col. Nelson W. Green was the first inventor of the driven well. The fact has been finally established by the Supreme Court, after a struggle of nearly twenty years. He never voluntarily abandoned his invention to the public. That fact was also finally established in the Supreme Court. He delayed his application over four years, through stress of circumstances arising out of the war. But in Beedle *vs.* Bennett the Supreme Court, stating those facts, said: "These circumstances sufficiently rebut and presumption which might otherwise have arisen of an intention on his part to abandon and dedicate to the use of the public the invention described in his patent."

The patent itself was effectual in form and substance to secure to him the broadest rights arising out of his invention. This was established by the concurring opinions of Judge Fisher, Commissioner of Patents, and Judges Benedict, Nelson, Dillon, Gresham, Wheeler, Blatchford, Nixon, McCrary, Shipman, and Sage, ten members of the federal judiciary. And it was finally affirmed by the Supreme Court in three cases on appeal. The reissue of the patent, strenuously attacked after the new ruling of the Supreme Court on that subject, was sustained in the circuits, and finally sustained in the Supreme Court, in Andrews *vs.* Eames.

But all this was of no avail. The invention was made and publicly shown in Cortland, N. Y., in 1861. It was so useful and so simple that some citizens who saw it put it in public use without the inventor's knowledge more than two years before his application for a patent. This fact was proved in the Patent Office, but Judge Fisher, on appeal, followed the construction of the act of 1839, then established by the courts, and adopted in Curtis on Patents, then the standard authority, and ordered the patent to issue. This construction had the sanction of Judges Shepley, Woodruff, McKennan, Benedict, and Blatchford, circuit and district judges, and of Story, Nelson, and Clifford, justices of the Supreme Court. And this construction was maintained and acted on for a period of nearly fifty years after the statute was passed. Receiving his patent from the government in pursuance of it, Col. Green and his assignees, upon the faith of it, made vast outlays in defending the rights thus granted to him. Entrenched behind this construction, a great body of rights and interests throughout the country has been built up.

It is now finally overthrown, and held by the Supreme Court to have been wrong from the beginning, and the patent is declared to have been unlawfully issued. There have been cases where courts of last resort, finding a line of decisions not in accord with their matured views, and finding also that large interests have long securely reposed upon them, have invoked the maxim *stare decisis* as a just ground for refusing to overthrow a statutory construction long settled and acted on.

In view of all the facts, the parties interested in the driven well patent throughout the country may reasonably feel that their case was one which deserved such judicial forbearance.—*Abstract from the New Jersey Law Journal.*

Self-control.

An expert and experienced official in an insane asylum said to us, a little time since, that these institutions are filled with people who have given up to their feelings, and that no one is quite safe from an insane asylum who allows himself to give up to his feelings. The importance of this fact is altogether too little appreciated, especially by teachers. We are always talking about the negative virtues of discipline, but we rarely speak of the positive virtues. We discipline the schools to keep the children from mischief, to maintain good order, to have things quiet, to enable the children to study. We say, and say rightly, that there cannot be a good school without good discipline. We do not, however, emphasize as we should the fact that the discipline of the school, when rightly done, is as vital to the future good of the child as the lessons he learns.

Discipline of the right kind is as good mental training as arithmetic. It is not of the right kind unless it requires intellectual effort, mental conquests. The experienced expert, referred to above, was led to make the remark to us by seeing a girl give way to the "sulks." "That makes insane women," she remarked, and told the story of a woman in an asylum who used to sulk until she became desperate, and the expert said, "You must stop it. You must control youself." To which the insane woman replied, "The time to say that was when I was a girl. I never controlled myself when I was well, and now I cannot." The teacher has a wider responsibility, a weightier disciplinary duty, than she suspects. The pupils are not only to be controlled, but they must be taught to control themselves, absolutely, honestly, completely.—*Jour. of Education.*

A Noble Retriever.

The *Western Mail* first published the following remarkable story of a brave dog: On December 29 last the steamship Muley Hassan was passing through the Straits of Gibraltar, when Captain Thomson went on deck with his retriever Nellie. The sagacious animal at once ran to the rail of the vessel, raised herself on her fore paws, and commenced to whine. The captain looked, but could see nothing. The dog, however, got more and more restless, and finally jumped overboard, and swam astern. The engines were stopped, and a boat lowered, when the dog was discovered, firmly holding the collar of the coat of a drowning man, who was lying across two oars. It was afterward ascertained that he was the only survivor from a Spanish revenue felucca, which had been upset in a squall, and that he had been in the water four hours when rescued. It would have been impossible for him to have survived much longer. Both man and dog were in a very exhausted condition when taken on board the Muley Hassan. The above incident has formed the subject of a presentation to Captain Thomson of a silver medal and diploma, for his gallantry and heroism in saving the life of the poor Spaniard. Without in the least wishing to depreciate Captain Thomson's effort or deserts, we must say that Nellie most certainly deserves to have some sort of honor conferred upon her, and that she certainly ought to be ranked among the historical dogs who have earned name and fame for heroic deeds.—*Swiss Cross.*

Value of a Hobby.

If we ever became vindictive toward a fellow man, and desired to punish him, we would deprive him of his hobby; without that, he would be lonesome in a crowd, and crowded in a wilderness, and would seek what he had lost and find it not. The business man with a hobby that he rides is a happy man; but if the hobby rides him, the business will suffer sooner or later. The man without a hobby will be found in the club room, the billiard room, or card room. The hobbyist, with his loft of pigeons, his bird skins or eggs, bugs or beetles, takes more substantial happiness than all the members of the highest toned club in a city combined. Besides that, home and Dame Nature is all the world to him and all the heaven he ever aspires to.—*Wade's Fibre.*

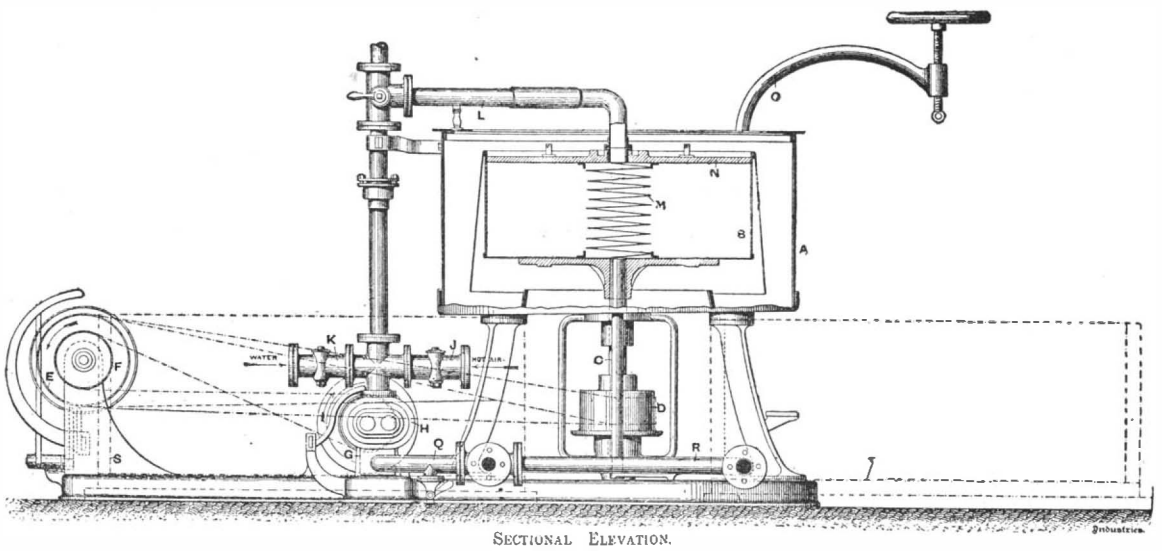
© 1887 SCIENTIFIC AMERICAN, INC.

CENTRIFUGAL DYEING AND BLEACHING APPARATUS.

Dr. A. Waldbaur, of Stuttgart, Germany, has recently invented an apparatus in which the process of dyeing or bleaching is performed at one operation by introducing the material to be treated into a rotating basket, and forcing the operating liquid by centrifugal action from the center of the apparatus outward through the material. By this means the various processes of bleaching, dyeing, and washing may be conducted in a continuous manner, without repeatedly transferring the material from one apparatus to another. A considerable saving of time is thus effected, and there is much less liability of the material being damaged than with the ordinary method.

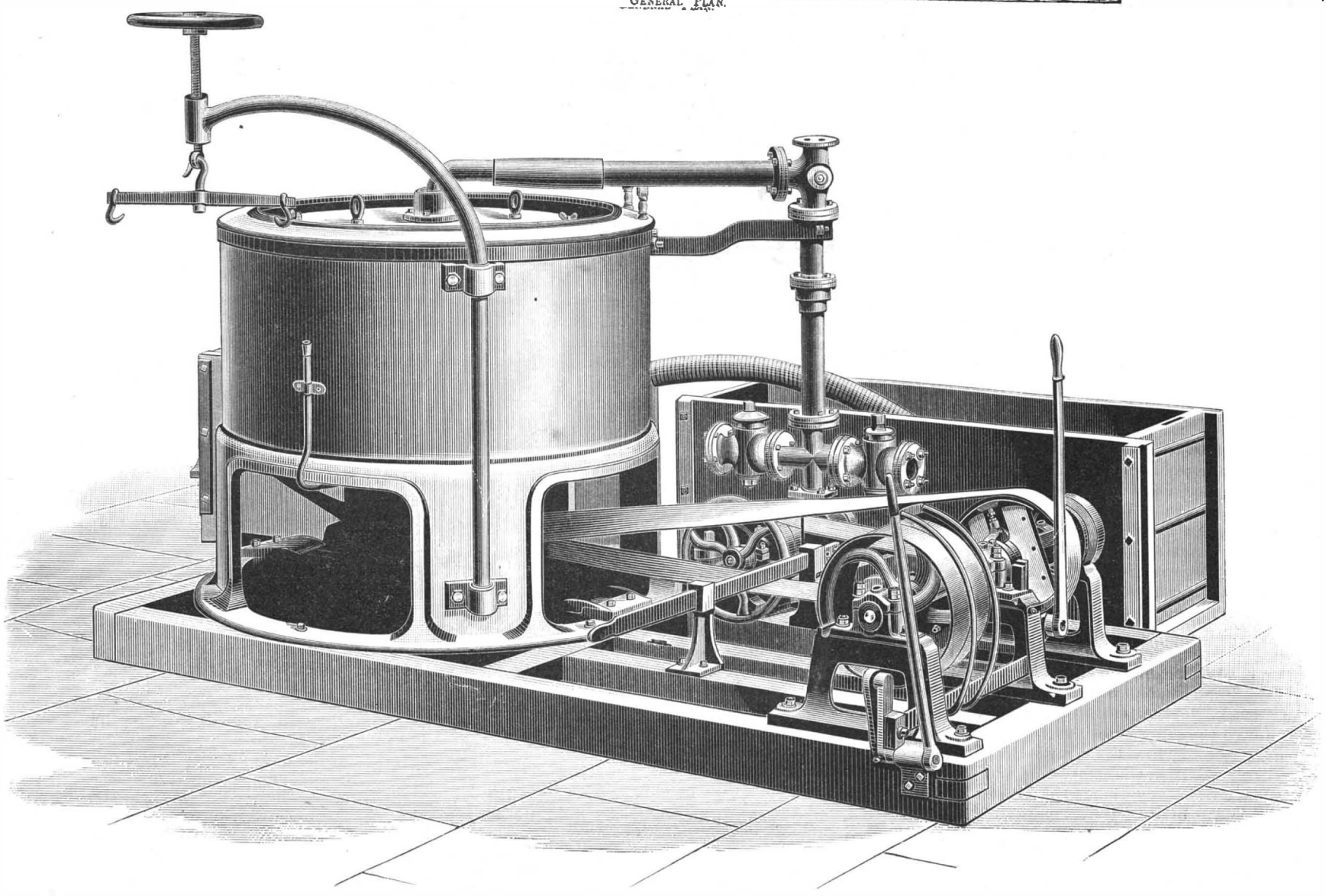
A general plant for carrying out this process is represented in the illustrations, which also show a sectional elevation and plan of the same arrangement. The casing, A, of the apparatus contains the rotating basket, B, which is mounted upon the vertical driving shaft, C, and is provided with a cover, N. In the middle of the rotating basket is arranged a spiral spring basket, M, serving to produce a hollow space, from which the operating liquid percolates through the material. This basket may be provided with contrivances for conducting the fluid toward its periphery. The supply pipe, L, for the liquids fits with its vertical end into a tubular boss in the cover, N, and it is provided with a connection for allowing it to be turned back or to sink with the cover.

The shaft, C, carries a pulley, D, which is driven [illegible] ranged on a suitable line of shafting. The pulley, F, is connected by a belt with the pulley, G, which drives a pump, H, used for effecting the circulation of the operating liquid. The tanks, S and T, are connected by pipes, R and Q, with the pump, H, and designed to hold the different liquids employed. Materials to the amount of from 100 pounds to 160 pounds, according to the size of the apparatus, are packed into the space between the basket, B, and the basket, M. The cover is then let down by a screw crane, O, and the pipe, L, is turned into position for supplying liquid. The basket is then set in motion, and the pump started to supply the desired liquid, the three-way cocks on the supply pipes being set accordingly. After passing through the apparatus the liquid is discharged through the flexible pipe, P, into either tank. The operation is continued for say twenty or thirty minutes, and the pump is then stopped, the basket continuing to rotate for about five minutes, until the remaining liquid has been completely thrown off. During this time the pump may be employed for raising the spent liquid into a reservoir for reconcentration. The material may then be similarly treated with other liquids, and finally hot air is admitted by the connection, J, for drying the material.—*Industries.*



SECTIONAL ELEVATION.

GENERAL PLAN.



CENTRIFUGAL DYEING AND BLEACHING APPARATUS.

Recovery of Soap from Water.

Alderman Taylor, chemist, of Rochdale, Eng., has lately completed an invention whereby the pollution of the river Roach by a local firm of manufacturers has been prevented, and at the same time a large saving effected in the working expenses. His experiments have been conducted on behalf of Henry Tucker & Co., silk manufacturers, who feared that an injunction would be obtained against them for polluting the river by the large quantity of soap water which came from their works. Mr. Taylor's process is as follows: The water containing the dissolved soap is run into a vault large enough to hold a day's "washings." Over this vault are two elevated tanks of the same size, and beneath them a retort is fixed. The soaped water is pumped from the vault into the elevated tanks, and chlorine, generated in the retort from hydrochloric acid and manganese, is forced into the liquid. This causes the refuse and fatty matter to gather in a cake at the bottom. The water in the tanks is then run off into the river, con-

© 1887 SCIENTIFIC AMERICAN, INC.

with the exception of a little common salt. The pollution of the river is thus averted. The cake of fatty matter and dirt is next turned to profitable account. It is placed in what are called the filter beds, and then pressed in a machine press until the fatty matter is extracted. The oil thus obtained is next made into brown soap, exactly similar to that which is used in the process of washing the raw silk. The soap is again used for washing purposes, and is found to answer quite as well as in its first application. Only 5 per cent of the original weight of soap is lost in the reclaiming process. The value of the invention is proved by the fact that the firm has been offered £20 per ton by wholesale dealers for the reclaimed soap.—*Chem. and Drug.*

THE WATERTOWN ARSENAL TESTING MACHINE.

(*Continued from first page.*)

head is filled with glycerine and alcohol. When a piece of metal is tried in tension, it is clamped to the ram and also to the weighing platform. Then the hydraulic pressure is turned into the pressure cylinder. The amount brought to bear at any moment is ascertained, not, as would normally be done, by noting the gauge connected to the pump cylinder, but by noting the pressure produced within the four cylinders between the weighing platforms. The motion of the pistons and cylinders is infinitesimal. They have no packing. The pistons are held concentric, and without touching the cylinders, by brass diaphragms. Being without sensible motion and without friction, the pressure within them indicates the exact stress to which the trial sample is subjected. When a piece is to be subjected to compression, the clamping is dispensed with, and the opposite end of the weighing mechanism is acted on, so that compression is still produced within its cylinders. In other words, a traveling ram is arranged for the adjustments of length, and this ram, when in action, is secured in place and made to work against a highly sensitive hydraulic dynamometer.

Pressure is produced by a steam pump working into an accumulator. The pressure in the weighing cylinders is communicated by reducing levers and hydraulic cylinders to an elaborate weighing mechanism. For certain classes of light strains of extended longitudinal range, as in Manila rope testing, the screws alone are used to produce the stress.

By it a stress of 1,068,000 lb. in compression or 801,100 in tension can be produced. In normal working pieces 30 feet long can be received; but by a special arrangement, pieces 31 feet long for compression, and 31 feet 3 inches for tension, can be introduced.

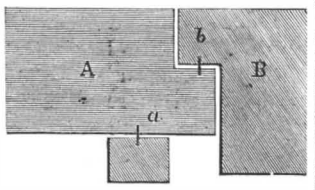
The ram or straining cylinder has an internal diameter of twenty inches and a stroke of twenty-four inches. The piston and rod are on one piece, turned up from a single forging. The cylinder is lined with rolled copper, to prevent the sperm oil used as filling from penetrating into the pores of the iron. Cup leather packings are used to prevent leakage.

The screws that hold the ram in place, and which receive the full strain and transfer it to the weighing platforms, are eight and one-half inches in diameter, measured to the outside of the thread. They are threaded with a truncated V thread, two to the inch, and are forty-eight feet long. They are horizontal, and parallel with the rails, are 50 inches apart and 47 inches above the floor. Their diameter from end to end calibrates within one thousandth of an inch. Intermediate supports are provided, which can be swung up, so as to secure them from vibration or bending.

On each side of the ram are the nuts which work on the screws and move it. These nuts are rotated by a "live head" bolted down to the foundation at the further end between the tracks. This resembles in general appearance a lathe head, and is worked by a straight or crossed belt, according to the direction of motion that may be required. It turns a long shaft, which can be seen running between the tracks close to the ground, and which is as long as the track. A groove is made in the shaft extending along its entire length. By a feathered wheel and connecting gear carried by the ram, the nuts are rotated so as to move it back and forth. The nuts are allowed a play on the screws of $\frac{2}{100}$ inch. They are made of bronze.

The ram is carried by a truck moving upon a track. The latter is made of cast iron, laid in sulphur, and bolted to the foundation.

At the end nearest the front of the picture are shown the scale platforms and abutments. In them the screws are held. A space is seen between the two platforms. Within this space are placed the four weighing cylinders. When the stress comes upon the sample, the screws are drawn or thrust, as the case may be, and the weighing platforms are pressed together. This tends to compress the weighing cylinders with their pistons. The free space between the cylinders and pistons is filled with a diaphragm of brass $\frac{5}{1000}$ inch thick. This keeps the piston centered and acts as packing. The extreme range of motion is $\frac{15}{1000}$ inch. The interior of the cylinders connects by a copper pipe $\frac{1}{10}$ inch internal and $\frac{18}{100}$ inch external diameter, with another smaller cylinder and piston, placed with its axis vertical within the scale box, and to one side of the machine. This pipe and smaller cylinder are also completely filled with the glycerine and alcohol mixture. The piston of the small cylinder actuates a lever, which, in its turn, connects with the scale beam on which the weighing is executed. This portion embodies in its general arrangement the principles that obtain in platform scales, with one distinguishing point of difference from ordinary practice. No knife edges are used. In their place thin strips of steel, called fulcrum plates, are employed. These vary in thickness from $\frac{8}{100}$ down to $\frac{5}{1000}$ inch. They are either set into or clamped fast to both members of the system.



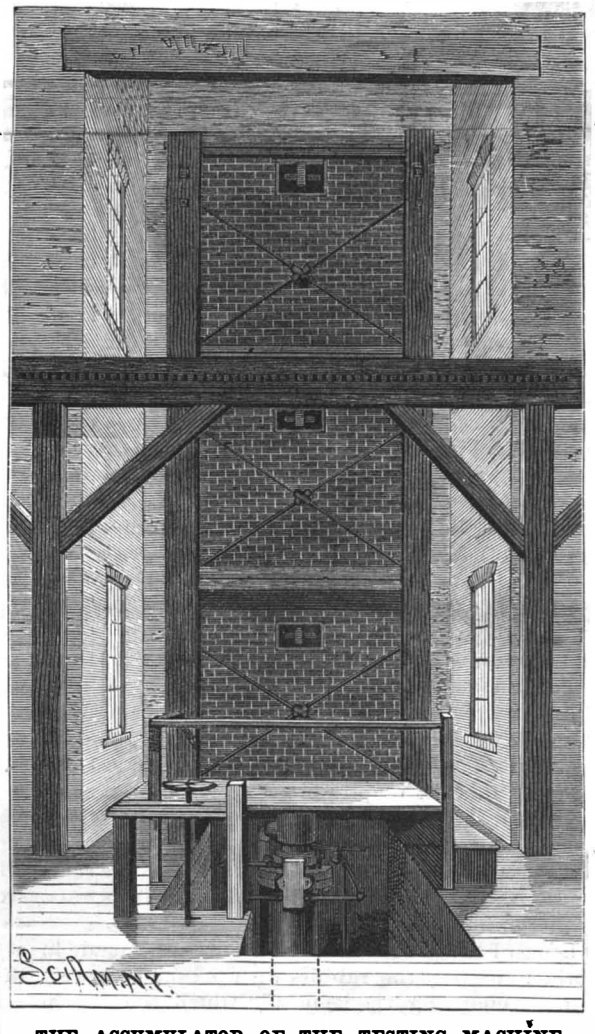
FULCRUM PLATES.

To illustrate this method, the first lever connections are shown in the cut. A represents the end of the lever. At *a* is a fulcrum plate which transmits the thrust from the smaller cylinder and piston just spoken of. Connected to the stationary abutment, B, a second fulcrum plate, at *b*, is provided. In ordinary practice knife edges would be used in both these places. These particular plates are $\frac{8}{100}$ inch thick, and are bedded $\frac{8}{100}$ inch in the metal.

As the large lever is pressed upward it communicates the pressure, reduced proportionately to the ratio of the length of its arms, to the scale beam by a vertical rod.

It will be seen that the infinitesimal movements of the pistons and original weighing cylinders are increased progressively. Above the scale beam is placed a long index beam which still further multiplies the extent of motion, so that a range 420,000 times greater than that of the pistons between the weighing platforms is obtained.

From the scale beam four rods depend, also suspended by fulcrum plates. By handles worked from outside the scale beam case, weights are added to or removed from these rods. On one rod from 700,000 to 100,000 pounds are weighed in 100,000 pounds at a time; on the next, from 100,000 to 10,000 pounds are weighed by 10,000 pounds increments; on the next, from 10,000 to 1,000 pounds are weighed by 1,000 pounds increments; and on the fourth rod, from 1,000 to 100 pounds are weighed by 100 pounds increments. A rider is provided that slides along the scale beam and weighs by single pounds up to 100 pounds. This gives a maximum of less than the full capacity. To obtain this a large counterpoise is removed, which adds at once 200,000 pounds to the effectual weights.



THE ACCUMULATOR OF THE TESTING MACHINE.

The extreme range of play of the index need not exceed a fraction of an inch, so that the movement of the weighing cylinders and pistons is quite inappreciable. As Mr. Holley, in his graphic paper, puts it, a motion of $\frac{1}{100}$ of an inch at the end of the index under the influence of a strain of one pound would indicate a motion of $\frac{1}{48000000}$ inch of the weighing pistons. The flexure of the fulcrum plates is also very slight. The accuracy of the machine hinges on these points, as by this absence of extended motion the resistance due to rigidity of fulcrum plates and diaphragms is done away with practically. There is no friction, properly speaking, in the system.

The scale beams are finished in the best manner, and all their principal parts are nickel plated or gilded. They are inclosed in a glass case.

The original power is derived from a steam pump. The steam cylinder is of the Knowles pattern, but has the piston rod extended through the back cylinder head. One end of the rod works a pump of 1½ inches diameter, the other a pump of ⅞ inch diameter. Cocks are so arranged that either the small pump alone may be used as the source of power for high pressure or both together may be employed, giving a lower pressure equal to that due to the larger one. Both pumps are of brass, and are double-acting.

The pumps force sperm oil into the working cylinder, an accumulator being used to secure steady action. This structure is of the usual type. It has two concentric rams, one of 10 in., the other of 5½ in. diameter. Either can be made the efficient one. It carries a central square wooden beam, to which the weights, composed of brick and mortar masonry, are keyed. These weights are in three parts, and can be used singly or combined. By utilizing the combinations of rams and weights, a pressure varying from 300 to 3,400 pounds per square inch can be secured, covering a range of total pressure of 119,400 to 1,068,000 pounds on the large or compressing face of the piston of the straining cylinder, and of 89,500 to 801,100 pounds on the small or tension face. The small face is the one reduced in effective area by the piston rod. The accumulator is provided with a safety valve to prevent any possibility of the rams being driven out of the cylinder of the accumulator.

The clamps for holding samples that are to be strained in tension are hydraulic. Their jaws are forced together by the pressure of the accumulator. Gauges are provided for showing the pressure they exert.

Owing to its great size and power, this machine can be used for large samples. Examples of its utility in this direction may be cited. A link of iron, 5 inches in diameter, was broken at a total pressure of 722,800 pounds, giving away with a loud report. Its diameter at the breaking surface was slightly diminished. This reduced to a breaking strain of 36,000 pounds to the square inch. Yet the piece was supposed to have a tensile strength of 60,000 pounds. Another piece of iron, turned down to 3⅝ inches diameter, broke at a tension of 37,000 pounds to the square inch. The same metal in a 1 inch bar had stood a 50,000 pound strain. At the beginning of the present year 14,000 specimens, principally for government work, had been tested. These ran from the finest wire up to full sized members of engineering structures. From 1 to 800,000 pound stresses were applied. Some specimens were less than 1 inch in length. Upward of 320,000 pounds of material had been tested to destruction. Brick piers and wooden posts have been among the objects tested.

Elaborate sets of calipers and all necessary accessories are supplied for testing elongation under stress, and other factors and data.

The absence of friction in the weighing apparatus is shown strikingly in the case of small strains. A horse hair producing a strain of one pound will affect the index. Yet to do this the weighing platforms and other mechanism theoretically have to move. The weight of metal put in motion thus by so slight an agent is 24,000 pounds. A paper by the late Alexander H. Holley, giving a general description of the machine, is printed in the Transactions of the American Institute of Mining Engineers for 1879; and a technical description, with outline drawings in projection, is given in the Annual Report of the Chief of Ordnance, U. S. A., for 1883.

Proposed Utilization of the Rhine Falls.

Some twenty miles below the point where it issues from the Lake of Constance the Rhine, with a width of 350 feet and an average depth of about 21 feet, plunges over a barrier of rocks, varying in height from 45 feet on the right bank to about 60 feet on the left. Including the rapids, the total fall within a distance of a little over a third of a mile is estimated at 150 feet. The volume of water passing over the falls per second varies from a minimum of 118 cubic meters in February to a maximum of 502 cubic meters in July, when, in consequence of the melting of the snows in the mountains and the rise in all the tributary streams and brooks, the Rhine reaches its highest point.

In this practical age of inventions and progress very few will be surprised to hear that an application has been made for a concession to utilize these magnificent falls, so familiar to travelers, for the manufacture of aluminum. The applicants are J. G. Nethers, Son & Co., Schaffhausen, iron workers, who ask for the privilege of constructing a dam from Laufen Mill to the railroad bridges, a length sufficient to furnish them with a volume of 75 cubic meters per second. If this is

© 1887 SCIENTIFIC AMERICAN, INC.

granted, a foreign contemporary says, they propose to establish works for the manufacture of aluminum, furnishing employment at first to 500 workmen and later to double that number. They estimate the water power requisite to carry on their works at an equivalent of 1,500 horse power, and submit with their application the necessary maps, plans, and drawings. They further announce that a company with a capital of 12,000,000f. (about 480,000*l.*) is prepared to conduct the enterprise, and they offer all reasonable guarantees against any marring or defacement of the natural beauties of the falls. The proposition is being met with a strong opposition, led by the hotel keepers and many others who are dependent on the tourist business.

The Rabbit Plague in Australia—Reward Offered for a New Invention.

A very large area of the arable lands of Australia is now overrun with rabbits. So numerous and active are these animals that they destroy trees, grass, crops, and everything that grows. They move in great armies, and carry destruction in their path. All efforts to exterminate them have so far proved fruitless. The authorities now offer the handsome reward of $125,000 for an effective method of overcoming the evil. The following is the text of the offer:

DEPARTMENT OF MINES,
Sydney, August 31, 1887.

It is hereby notified that the government of New South Wales will pay the sum of £25,000 to any person or persons who will make known and demonstrate at his or their own expense any method or process not previously known in the Colony for the effectual extermination of rabbits, subject to the following conditions, viz.:

1. That such method or process shall, after experiment for a period of twelve months, receive the approval of a board appointed for that purpose by the Governor, with the advice of the Executive Council.

2. That such method or process shall, in the opinion of the said Board, not be injurious, and shall not involve the use of any matter, animal or thing which may be noxious to horses, cattle, sheep, camels, goats, swine, or dogs.

3. The Board shall be bound not to disclose the particulars of any method or process unless such Board shall decide to give such method or process a trial.

FRANCIS ABIGAIL.

All communications relating to the above must be addressed to the Honorable F. Abigail, Secretary for Mines, Sydney, New South Wales.

Some time ago the Inspector of Stock of Victoria, in an official report, gave the following account of the rabbit pest in that colony:

Rabbits are to be found, less or more, all over the western and northwestern portions of Victoria, and as far up the Murray as the Owens River, but in no great numbers as yet, and from Echuca upward they are principally confined to the banks of the river. In the western districts they are very numerous and destructive, and in the Wimmera, where the country is comparatively scrubby and poor, it may be said they have all but taken possession of the crown lands, and to a large extent also of the alienated land. On one property alone in the Colac district it is said that between $150,000 and $200,000 have been spent in destroying rabbits, while some owners are paying as much as $10,000 a year to keep them down, many $5,000 a year, and almost every holder of land is year by year put to a considerable expense in protecting his pasture and crops from these pests.

A great many modes of dealing with this evil have been tried in Victoria, viz., fencing the rabbits out, shooting, hunting with dogs, ferreting and netting, snaring and trapping, digging out and blocking up the burrows, and destroying the rabbits with noxious gas and poison. In all these modes, again, the work is at times done by the owner's own men, sometimes by contract, and at other times under the bonus system. When the rabbits are to be fenced out, a wire netting, 4 feet broad, with 2½ inch mesh, is put on an ordinary wire fence, the netting to the extent of one foot being bent and put in the ground at an angle to prevent the rabbits from burrowing. They try to do so close at the foot of the fence, but stop when they come upon the netting. The cost of the netting for a fence rabbit proof of this sort is about $250 a mile; and if it is found that rabbits cross the Murray after our land is cleared, and Victoria continues to be infested, it may be necessary to run a rabbit proof fence along the river to keep them from again obtaining a footing in this colony. Dogs (terriers, cockers, and other dogs which hunt by scent) and guns are generally used together, though sometimes kangaroo dogs and greyhounds are taken out with the terriers to kill the rabbits they put up. Where the rabbits have made a settlement, the most effective, but the most expensive, way is to dig them out, or, where it can be done (in rocky and stony ground), to block up the burrows and starve the rabbits in their holes. Ferreting and netting is also a very successful mode of destroying them; but ferrets are comparatively scarce, they are liable to be lost, and every one cannot manage them. A good many have also been taken in traps and snares, but these appliances are also expensive and comparatively slow.

The exterminator (the machine employed to charge the burrows with noxious gas) is also in some cases an effective mode, but it is expensive, and the machine is cumbersome and unwieldy to take about, while the holes at times in the warrens are of such a sort (as in the case of bilbee and wombat holes, of which the rabbits take possession) as to render the gas inoperative; and in other cases there are fissures in the ground which allow it to escape. A good many different sorts of poison have been laid, and in a great many different vehicles.

1. *The Poison.*—The poisons most frequently used have been arsenic and phosphorus, and in a few cases strychnine. Arsenic has been longest used, generally in conjunction with sugar and bran. Phosphorus, again, has been more recently tried, and is now far more generally laid than any other poison.

2. *The Vehicle.*—A mixture of crushed wheat and sugar, or bran and sugar, has been found an excellent vehicle, so far as destroying the rabbits is concerned, but the mixture is dangerous for stock, more especially sheep. Whole wheat has been used successfully, with arsenic, and latterly with phosphorus, but does not seem to retain the poison so long as the oats, and is more liable to be eaten by sheep. Oats have within the last few years been employed very successfully and extensively as a vehicle for phosphorus. Carrots have also been tried with good results as a vehicle for arsenic. This is what was to be expected, as all animals are fond of carrots, but the supply is comparatively limited, and in many cases they cannot be laid without endangering the stock; they are poisoned by bruising the outside and strewing it with arsenic. Potatoes have been used successfully as a vehicle for strychnine, and could of course also be used for other poisons, especially arsenic. Turnips, pumpkins, and melons could be used in the same way as carrots, and cabbage leaves, turnip tops, green corn, and sorghum could also be made vehicles by slitting or opening them, where there is room, and laying the poison in slits or openings. But all these, like carrots and potatoes, can only be used where the stock can be removed from the paddock, or where these vehicles can be laid where the stock cannot get them. In cases, however, where the rabbits have been reduced in number, and it is of course of great importance to complete their destruction, sufficient precautions could be taken by laying down hollow logs, digging holes in the ground, fencing off small patches, and in other ways to keep the stock from reaching the poisoned vehicle.

Oil of rhodium has been employed successfully in conjunction with some of these vehicles as an attraction for the rabbits, and, although expensive, might be added where they cannot otherwise be induced to take the poison, or it might be so to make them take it more readily. The reports under this head are very conflicting with regard to effect of poisoned grain. It is allowed that the poisoned grain is not nearly so successful when the grass is green and plentiful as it is when dry and scarce. It is also generally allowed that while oats and wheat poisoned with phosphorus have at first been successful in destroying the rabbits, it is at the same time the opinion that the rabbits after a time cease to take either the one or the other. I think, however, that these results are only what were to be expected. When the grass is plentiful and green, not only will the rabbits be comparatively careless about food such as oats or wheat, but they will not be so likely to see the grain on the ground as they would when the grass is brown and bare. Then, again, all animals are endowed in a greater or less degree with the instinct which leads them to refuse to take what they see is destroying them. The rabbits would at first—and perhaps for a little time in the case of arsenic, and longer in that of phosphorus, which is a slow poison—take the grain; but as soon as those which took it began to die in any number, the others would stop eating the grain. It is well known that the same thing happens where poison is laid for native dogs, rats, and other animals.

Although I think the failure of the attempts made in Victoria to destroy the rabbits with poison is largely due to not changing the vehicle in which the poison was laid, the main cause of the failure there has, in my opinion, been the want of simultaneous action on the part of the owners whose land was infested with rabbits. The law in Victoria is only applicable to a portion of the lands of the colony—that alienated by the crown; and even in the case of land to which the law does apply it has very seldom been enforced, for it has provided no penalty for neglecting to destroy. There the defaulting owner can only be compelled to do so by the shire councils—who have the carrying out of the act—putting men on the defaulter's holding to destroy the rabbits; and, like our own boards of directors, these councils dislike to exercise this power, and have seldom or never done so. The result has been that while some owners did all they could to clear their land, others did nothing. The rabbits are, therefore, increasing in some districts; as numerous as ever in others; and, although a great many have been destroyed, their spread has not been really checked, for they are every other month making their appearance in fresh districts. Under these circumstances, it is not surprising that in Victoria owners speak hopelessly of being able, except at an expense which would be most oppressive, to do more than keep the rabbits down; but there is little doubt that the result there would have been altogether different had owners been compelled, as they can be in this colony—and as I trust they will be—to carry out the work of extermination promptly and simultaneously on all the holdings.

The Flea.

Fleas love dirt, and in it they flourish and multiply most abundantly. But in spite of St. Dominic's curse and their unclean haunts, they are interesting little fellows. Let us put one under the microscope. It seems to be clothed in a sort of armor formed of brown overlapping plates, that are so exceedingly tough as to be almost indestructible. Its head is small and very thin, and it has a single eye upon each side. This eye is black, and the rays of light scintillate within it like sparks of fire. Puget managed to look through one of these eyes, and he found that it diminished objects in size, while it multiplied them in number—a man appearing like an army of fairies, and the flame of a candle becoming a thousand tiny stars. From the shape of its head, and for other reasons, the flea is supposed to use only one eye at a time. The offensive weapon of the flea is composed of two palpi, or feelers, two piercers, and a tongue. When it feeds it stands erect, thrusting this sucker into the flesh, and it will eat without intermission until disturbed, for it voids as fast as it swallows its food. It is interesting to put several in a glass, and, giving them a piece of raw meat, see them all standing on their hind legs to suck up its juices.

Their manner of breathing is still undetermined, but it is thought most probable that they receive air into their bodies through small holes at the ends of the palpi.

The legs of a flea are marvels of strength and elasticity. They are joined to the body by long tendons that act like wire springs. In making its leap, which, it is said, can cover two hundred times its own length, the flea draws the leg close up to the body, and then throws it out with great force; but the impulse proceeds from the first joint alone, the others only increasing it by their stretch while the leap is being made.

Fleas are possessed of great strength.—Mouffet tells of a mechanic who made a gold chain, as long as his finger, that a flea dragged after him; and a golden chariot, which he drew also. Bingley writes of a watchmaker in the Strand who had an ivory four-wheeled chaise, with a coachman on its box, drawn by a flea. The same man afterward made a carriage with six horses, a coachman, four persons inside, two footmen behind, and a postilion on one of the horses, all of which were drawn by a single flea. Latrielle mentions a flea which dragged a silver cannon, of twenty-four times its own weight, mounted on wheels, and showed no fear when it was charged with gunpowder and fired off. Rene says that he saw three fleas drawing a tiny omnibus; that a pair drew a chariot, and that a brass cannon was dragged by a single one.

There are several varieties of fleas, but they are so much alike that their differences are interesting only to scientific people. The cat flea will do as well as any to show us the process of breeding. During the spring and summer months she simply drops her eggs into the fur of the cat, but in the autumn and winter she glues each firmly upon a hair. These eggs are so small as to be barely visible to the naked eye, but under the microscope they are very beautiful, looking like the loveliest pearls, and are perfectly translucent. The flea deposits nearly two hundred at a time, running about and dropping them here and there. They soon hatch into small, white, footless worms. In from one to two weeks they go into cocoon. Nothing can be prettier than this cocoon. I wish I could show it to you, but will try to describe it. It is like a flask of clear glass, tinged at the edges with pearly tints, and dotted over with gold. The little sleeper within lies in a circle, is rose colored, and looks like the delicate petal of a flower. In about six weeks he reaches maturity. At first he is not larger than a mite, but when well fed grows quickly in size and strength.

Fleas are quarrelsome, and great fighters. When several are confined in a glass, they will stand on their hind legs, striking at their opponents with the others, and roll over and over each other, losing legs and antennæ, and at last giving up their lives in the fight. There is a record of a flea which lived ten days after such an encounter, with no antennæ; three plates of his side broken in; one eye gone; and with only four legs, and these cut off to the first joints.

Fleas are supposed to feel a great antipathy to worm wood and other bitter herbs; and, in England, the country people have a habit of placing these about their cottages for the purpose of banishing the lively little pests.—*S. L. Clayes, Swiss Cross.*

© 1887 SCIENTIFIC AMERICAN, INC.

SCIENTIFIC EXPERIMENTS WITH SIMPLE APPARATUS.

BY GEO. M. HOPKINS.

ACOUSTICS, LIGHT, AND HEAT.

To concentrate and project light, heat, and sound by means of concave mirrors is generally supposed to necessitate the use of expensive parabolic mirrors, articles practically out of the reach of amateur experimenters, and not to be found in every institution of learning. To perform most of the experiments possible with concave mirrors, the spun metal reflectors used in large

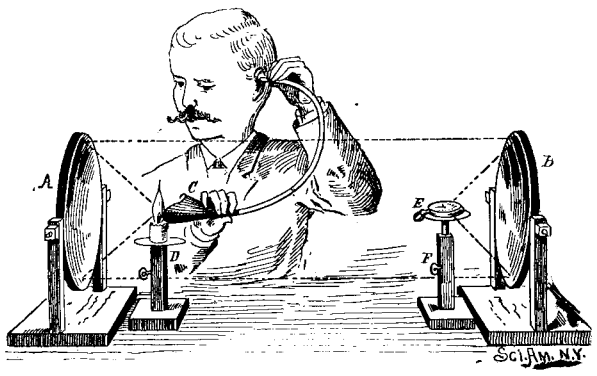


Fig. 1.—REFLECTION OF LIGHT AND SOUND.

lamps answer exceedingly well. The projection of images and the accurate determination of the foci are the only experiments impossible with such reflectors. The largest size to be found ready made is 10 inches in diameter, with a principal focus of about 8 or 9 inches. The price is $1 50 per pair. To prepare them for use, two common wood screws are secured to them at diametrically opposite points, the heads of the screws being soldered to the edges of the mirrors, so that the screws project radially. Each mirror is provided with a stand formed of a base and two uprights. The wood screws project through the uprights, and are provided with wooden nuts.

To facilitate the experiments to be performed with the concave mirrors, two or three small stands are required. It is desirable that these stands be made adjustable. If nothing is at hand that will answer the purpose, a very good adjustable stand may be made by soldering a disk of tin to the head of a 4 inch

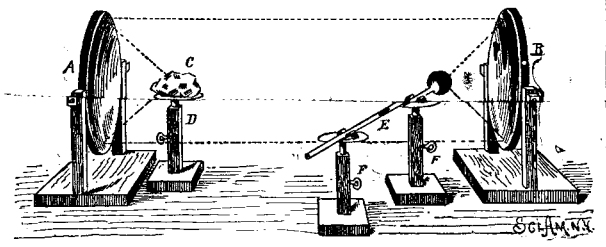


Fig. 2.—REFLECTION OF HEAT.

wood screw, and inserting the screw in a short column, as shown in the engraving. A paper trumpet, 8 inches in diameter at the larger end and 2 feet in length, is useful, and a rubber tube having a small funnel at one end and an ear piece at the other end is necessary.

To show the concentrating power of one of these common reflectors, place it so that its concave surface faces the sun. Then place a piece of dark colored cloth in the focus. It is at once ignited.

Place two reflectors, A B, 4 or 5 feet apart, with their concave surfaces facing each other, as shown in Fig. 1. Place a short candle on the stand, D, so as to reflect a parallel beam that will cover the reflector, B, as nearly as possible. Then place a watch, E, in the focus of the reflector, B, upon the stand, F. Now hold the funnel, C, with its mouth facing the reflector, A, and immediately behind the candle, or, better, remove the candle and place the funnel in the position formerly occupied by the candle flame. With the funnel at this point the ticking of the watch will be distinctly heard, but a

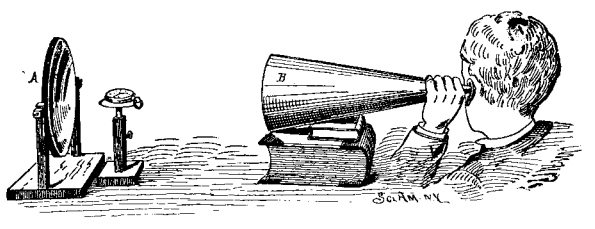


Fig. 3.—REFLECTION AND CONCENTRATION OF SOUND.

slight movement of the funnel in either direction will render the ticking inaudible. This experiment shows that the laws governing the reflection of light and sound are the same.

Instead of placing the watch in the focus of the reflector, B, support an air thermometer, E, upon two stands, F F, as shown in Fig. 2. Two inverted W-shaped pieces of tin will hold the thermometer in place. Smoke the thermometer bulb over a candle, and when it is almost cold introduce a drop of water or mercury, which will act as an index. Remove the candle until the drop in the tube ceases to move, then replace the candle. In a very short time the drop is pushed outward by the expansion of the air in the bulb. Again remove the candle, and when the drop has returned to the point of starting and ceases to move, place a lump, C, of ice on the stand, D, in the focus of the reflector, A. Immediately the air contracts in the thermometer and draws the drop in. This experiment shows that heat may be reflected in the same manner as light and sound.

In Fig. 3 the use of the trumpet in connection with a concave reflector is illustrated. The reflector, A, is adjusted to the trumpet, B, by means of the light of a candle placed on the stand in the focus of the reflector. Afterward the candle is replaced by the watch. With this arrangement the watch may be heard 20 or 30 feet away.

THE CONDUCTIVITY OF METALS.

The conductivity of metals for heat is admirably shown by the simple device shown in Fig. 4. To a strip, A, of iron are attached strips, B C, of brass and copper. The ends of all the strips are bent upward and inward, and the ends of the strips are split and curved to form loops for loosely holding matches, the sulphur ends of which rest upon the strips by their own gravity. The junction of the strips is heated as shown. The match on the copper strip ignites first, that on the brass next, and that upon the iron last, showing that, of the three metals, copper is the best conductor of heat and iron the poorest.

EASILY MADE TREVELYAN ROCKER.

This apparatus consists of a short piece, A, of lead pipe, about an inch in diameter, and a piece, B, of thick brass tubing, about ¾ inch outside diameter and five or six inches long. The lead pipe is flattened a little to keep it from rolling, and the surface along the side which is to be uppermost is scraped and smoothed. The brass tubing, B, is filed thin upon one side, near one end, and the thin part is driven in with the pein of a hammer or a punch so as to leave the longitudinal ridges, *a a*, as shown in the end view in Fig. 5.

When the brass tube is heated and placed across the

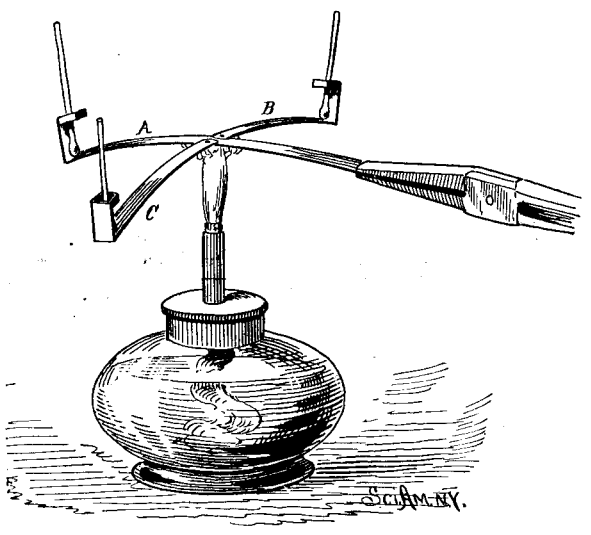


Fig. 4.—CONDUCTIVITY OF METALS FOR HEAT.

lead pipe, as shown in Fig. 5, with the ridges, *a a*, in contact with the lead pipe, the brass tube begins to rock, invisibly, of course, but with sufficient energy to give forth a clear musical note. If it does not start of itself, a little jarring will set it going, and it will continue to give forth its sound for some time.

The accepted explanation of this phenomenon is that the contact of the hot brass with the lead causes the lead to suddenly expand and project a microscopic distance upward. These upward projections of the lead alternate between the two points of contact, and thus cause the tube to rock with great rapidity and regularity.

In Fig. 6 is shown a modification of the experiment, in which the lead is indented to form the two contact surfaces, *a a*, and the heated bar, B, is made to rock at a comparatively slow rate, giving forth a grave note. By careful manipulation, the bar may be made to rock both longitudinally and laterally, thus giving forth a rhythmic combination of the two sounds.

MERCURIAL SHOWER.

A very simple way of producing a mercurial shower is shown in Fig. 7. In the neck of an Argand chimney is inserted a plug of Malacca wood, which is sealed around the periphery with wax or paraffine. In the top of the chimney is inserted a stopper, through which projects a short glass tube, having its upper end bent over, or capped with a small test tube. To the outer end of the glass tube is applied a rubber tube. When the chimney is in an inverted position, as shown in the engraving, a quantity of mercury is placed in the larger part of the chimney, and the air is partly exhausted from the chimney, by applying the mouth to the rubber tube and sucking. The mercury readily passes through the porous wood and falls in a shower. By employing an air pump for producing the partial vacuum, the mercury may be drawn through a plug of pine. These experiments show in a striking manner the porosity in a longitudinal direction of these pieces of wood.

Memory of the Horse.

A writer in *Wallace's Monthly* tells a good story of the famous horse Messenger, which had once belonged to a Mr. Bush, and which after his transfer to other hands had acquired notoriety for his ferocity. It seems that years after he was sold, Mr. Bush determined to see his old favorite, whom he found kept in a pasture surrounded by a fence ten feet high, through a hole in which the food and water were passed to Messenger as if he were "a dangerous convict." Mr. Bush was warned not to enter the inclosure for his very life, but he went in and, unobserved, concealed himself behind a tree and whistled. With a neigh the grand old fellow came bounding across the field in search of the

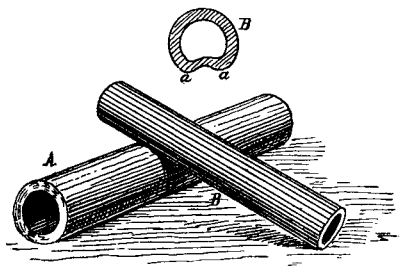


Fig. 5.—TREVELYAN'S ROCKER.

well remembered whistle. The horse raced around the pasture, and when at the height of his run Mr. Bush exposed himself and whistled again, Messenger wheeled and made directly for him, while the outlookers trembled in terror. But instead of seeking to kill, the horse came up gently and laid his head over his old master's shoulder to receive the customary caress. When Mr. Bush's time for departure had come, he had proceeded but a few yards from the inclosure when there was a crash, and out Messenger came, bounding through the strong bars. He followed his former owner to the stable gently, where he was secured by strong ropes, and for a long, long distance upon the road homeward Mr. Bush could hear the noble animal neighing, lashing the stall, and struggling to be free and follow.

Six Hundred Pounds Gas Pressure.

The Wheeling Natural Gas Company, of Pittsburg, have lately been conducting some experiments with

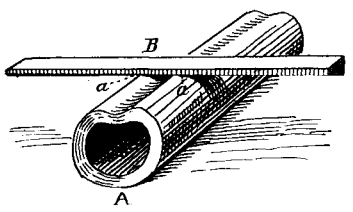


Fig. 6.—ROCKING BAR.

their weaker wells, to see what the result of deeper drilling would be. The original depth of the wells was from 2,100 to 2,200 feet, where the third sand is found. At a depth of about 2,300 feet, there began to be signs of another good sand, and a few more plunges of the drill tapped the rock. The gas blew out with such force that the tools would not go down any longer, and the drilling was stopped. A careful test of the first well showed a pressure of over 600 pounds, which is nearly as much as the largest of the famous Grapeville wells. Three or four other wells, when put down to the fourth sand, showed the same result. The lucky find is a new sand 150 feet below the old

Fig. 7.—MERCURIAL SHOWER.

gas-producing streak, and it promises to not only double the production of the Hickory district in Washington County, Pa., but also to throw new light on gas developments in the other fields. The company drilled another well in on the 29th ult., and its life is renewed, the well now being better than ever.

© 1887 SCIENTIFIC AMERICAN, INC.

ENGINEERING INVENTIONS.

An automatic station indicator has been patented by Mr. Charles W. May, of Omaha, Neb. The invention covers a novel construction and arrangement of parts for a device to be actuated by the motion of a car, to automatically indicate the streets, stations, and other prominent points on the route.

A boiler cleaner has been patented by Messrs. Robert S. Smith and John Meiklejohn, of St. Thomas, Ontario, Canada. It is a flue cleaner attached to a cleaner plate or carrier, with rods by means of which the plate and its cutters may be moved along the tubes, and clean the latter of accumulations and sediment.

A rail joint has been patented by Mr. George J. Ferguson, of Greenville, Texas. It is a device designed to make the joints equally strong with other parts of the rails, providing for modifications and variations in structure, the improvement being also applicable to close joints at switches, frogs, and guard rails.

An automatic railway station indicator has been patented by Messrs. William B. Bradsby and Edward W. Hagee, of Greenville, Ill. It is for displaying to passengers on cars the names of successive stations along the route, and working automatically, the invention consisting of novel features of construction and the combination of parts.

A car coupling has been patented by Messrs. Thomas Kirby and Abram Singer, of Petoskey, Mich. The invention covers certain novel features of construction and the combinations of parts in a coupler designed to be perfectly automatic, and which can be conveniently used in connection with the ordinary drawhead and link coupling.

A dredging machine has been patented by Mr. Cornelius C. Sullivan, of Roorkee, India. It consists essentially in a pair of jaws or cutters, forming when closed a scoop or bucket, and an oscillating hammer for driving the jaws or cutters into the soil by percussion, the jaws and hammer being pivoted on a common axis, with a hoisting chain and subsidiary parts for working the hammer, opening and closing and hoisting and lowering the bucket.

AGRICULTURAL INVENTION.

A forcing frame has been patented by Mr. Jacob Siem, of Homburg-vor-der-Höhe, Germany. It is an arrangement for producing and maintaining the heat of hot beds for horticultural purposes by means of hot water, a hot water reservoir being arranged below the bed, in which the inlet and outlet pipes are so located that the water heated in a boiler outside continually circulates to maintain a uniform temperature.

MISCELLANEOUS INVENTIONS.

John S. Moore, of Corvallis, Oregon. It is made of a decoction of tea in water, salt, borax, aqua ammonia, glycerine, bay rum, tincture of cantharides, musk and other perfume, compounded in certain proportions and manner specified.

A shoe sole plate has been patented by Mr. Charles Williams, of Blenheim, Marlborough, New Zealand. It is a metal toe plate, having on its ground bearing surface inner and outer grooves, with apertured countersunk portions to receive screws or other fastenings for attaching the plate to the sole.

A scaffolding has been patented by Mr. William S. Welch, of Westfield, N. J. It is for use on sloping roofs where the gutter cannot be utilized, and in connection with ordinary ladders to make a swinging scaffold, the invention covering various novel features of construction and the combination of parts.

A paper file has been patented by Mr. John M. D. France, of St. Joseph, Mo. It has a base or main plate, ratchet arms secured thereto having their rack teeth provided with beveled upper surfaces, with a slide plate and locking bar, making a convenient device for filing bills and papers.

A salt cellar has been patented by Mr. Metellus Thomson, of Kenton, Ohio. Its top is provided with a slot or slots, with a disk or disks operating therein, sockets receiving the salt when in the cellar and discharging the salt when the disk is turned to bring the sockets out of the top.

An axle skein has been patented by Mr. Edmund N. Hatcher, of Columbus, Ohio. The invention consists in forming an axle skein of a single piece of metal, and in cutting the blank in such manner that angular recesses in the edges are avoided, and also in novel details of construction.

An oil cup has been patented by Mr. Samuel D. Mershon, of Rahway, N. J. It is adapted for use on moving bearings, as crank pins, cross heads, and eccentrics, and is of a novel construction, calculated to feed an ample quantity of oil when the machinery is in motion, but none when it is stationary.

A post hole digger has been patented by Mr. James H. Humphrey, of Platte City, Mo. This invention relates to a device with plungers for removing the earth from the cylinder when filled, and also for packing the earth in the cylinder to retain it therein when being raised out of the hole, there being various novel features of construction and arrangement.

A harness pad has been patented by Mr. William S. Webster, of Newark, N. J. The back pad is formed without a jockey, the skirt on each side being made continuous from the saddle to the lower end and an opening being formed therein for the back band to pass under the skirt at a point somewhat below the terret.

A calf weaner has been patented by Mr. Robert L. Rickman, of Graham, Texas. It consists of a simple arrangement of pivoted plates, which can be readily adjusted upon the nostrils of a calf so that it will breathe without difficulty, with projecting points that will prick the cow when the calf attempts to draw milk.

An electric door opener has been patented by Mr. Albert C. Woehrle, of New York City. Besides a special construction of the door opener, the invention consists principally in so arranging the electrical connections that the circuit will be broken when the door stands open, also when closed and the button has been once pressed.

A galvanic battery has been patented by Mr. Frank J. Crouch, of Eugene City, Oregon. It is of that form in which one of the elements is revolved to constantly bring new portions of the same into contact with the exciting fluid, the invention covering novel features of construction and arrangement of parts.

A stove has been patented by Mr. Richard A. Rew, of Pomeroy, Washington Ter. The invention covers a peculiar construction of the supply pipe, and the combination of the pipe and stove, whereby the air will be taken from the lower stratum in the room, thus withdrawing the foul air, at the same time preventing danger from sparks.

A door check has been patented by Messrs. James P. and James H. Swift, of Evansville, Ind. The invention provides for the ready adjustment of a curved locking bar for variously hinged doors, furnishing a latch for working the check bolt, with arrangement for locking the latch, locking the door, and sounding an alarm by the turning of the door knob.

A thermotic valve controlling device has been patented by Mr. Henry Deymann, of Toledo, Ohio. One of the connected pipes has an air chamber at its upper end, a tube extending into the pipe and into the air chamber and connecting with a diaphragm upon which is supported a rod or stem, the upper end of which fits into the flame passage of the burner.

A process of waxing paper has been patented by Messrs. Charles A. Wilkinson, of East Somerville, and William S. McDonald, of Boston, Mass. It is a process wherein the web of paper is drawn over a blanket saturated with heated wax or paraffine, the wax being distributed upon a web in contradistinction to being distributed upon a sheet of paper.

A car starter and brake has been patented by Mr. Charles Merckelbagh, of Brussels, Belgium. By the ordinary brake shaft and handle an apparatus is set in motion whereby the car may be stopped, while the momentum is taken up by springs, which, when released, operate upon the axles to give the car a forward impetus.

A folding anchor has been patented by Mr. Thomas G. Edmondson, of Tarpon Springs, Fla. It has a slotted shank, with an eye near the crown, and is so made that the stock may be readily folded along the sides of the flukes to render the anchor compact when stowed, while it may be readily cleared when the flukes become fouled by obstructions.

A ladder has been patented by Mr. William Horsefield, of Morristown, N. J. Combined with the ladder is a screw rod to pass through the side pieces of the ladder and enter the side of the building to hold the ladder in upright position, there being also side projections to space the ladder from the side of the building, particularly adapting it for painters' use.

An animal trap has been patented by Mr. Evans Wood, of Lyons, Texas. A spear is fitted to slide in a frame, there being a spring to force the spear down, a pivoted trigger, and other novel features, the trap being designed to catch burrowing animals, of simple construction, and one which will operate equally well when set vertically or at an angle.

A stirrup has been patented by Mr. John P. Walker, of Grand Forks, Dakota Ter. It has lower and upper rollers journaled on its main frame, the frame and its lower rollers being swiveled to the stirrup strap loop, with other novel features, the construction being such that, should the rider be thrown, his feet would slip readily from the stirrups.

An electric gas lighter has been patented by Mr. Justus B. Entz, of New York City. This invention relates to burners in which the gas is automatically turned on and a spark produced at the burner tip to ignite on closing the lighting circuit, and on closing the extinguishing circuit the gas is turned off, the device being compact, efficient, and economical.

The cleansing, disinfecting, and testing of drain pipes in dwellings and other structures forms the subject of a patent issued to Mr. William D. Schuyler, of New York City. The drain pipe common to all the receptacles has independent discharge connections, with valves between the receptacles and the drain pipe, with independent hand valves in the drain pipe below, and other novel features.

A templet for use in gaining stair stringers has been patented by Mr. William H. Parry, of New York City. The plate is formed with slots meeting at an angle bounded on either side edges and having rounded extremities, with other novel features, making a convenient device for gaining stair stringers for the reception of treads and risers, and readily adjustable for stairs and winders of different pitches.

A wagon brake has been patented by Mr. Charles W. Loomis, of Otisville, N. Y. An arched shaft forms the main crank or lever of the brake, and the brake blocks upon the ends of this shaft are each acted upon by a spring coiled about the shaft and connected to the blocks in such a way as to normally hold the upper end of each block away from the wheel, the brake being very powerful.

A shell capper and extractor has been patented by Mr. Peyton A. Lee, of Coushatta, La. Combined with a shell holder having a capper is a magazine at right angles to the holder and having a cap-receiving track, its delivery end terminating in a space in the path of the capper, with a spring-impelled follower to automatically force the caps out of the magazine into the path of the capper.

A coin operated induction coil has been patented by Mr. William R. Pope, of Baltimore, Md. It is a device for administering electricity, so constructed that the circuit will be broken except just at the time when made operative by the insertion of a coin or other detached article, so that the instrument may be set up in public places to care for itself and make its own collection.

A velocipede has been patented by Mr. David Horn, of Carterville, Ill. It is designed to make the main wheels seven to eight feet in diameter and the steering wheel four to five feet in diameter, the weight of the rider being carried from a point below the axles of the main wheels, making a vehicle which can be propelled at high speed on ordinary roads and readily steered in any direction.

A fishing reel has been patented by Mr. Elbert B. Porter, of Penn Yan, N. Y. It has a fixed spring barrel and friction spring therein, in combination with a driving spring, a reel inclosing the barrel, planetary gearing between the barrel and reel, and a system of gearing for winding the spring, whereby perfect control of the line and the fish may be secured, and the tension of the line accurately regulated.

A corkscrew has been patented by Mr. Ernest D. Williams, of Boston, Mass. The handle has a socket carrying a spring pawl, in combination with a pointed screw or worm which carries a ratchet and is formed with a squared portion just below the ratchet, being operated with a rotary reciprocating motion to advance the screw into the cork, while the turning of the handle to the left withdraws the cork.

A sash fastener has been patented by Messrs. Nicholas B. McGrath and John H. Pierce, of Plantsville, Conn. It is adapted to be attached to either the upper or lower sash, or to either the right or left hand side of the sash, the construction being cheap and simple, and such that the main parts can be cast without cores and put together without boring or extra fitting.

SCIENTIFIC AMERICAN
BUILDING EDITION.

DECEMBER NUMBER.

TABLE OF CONTENTS.

1. Elegant Plate in Colors of a Suburban Dwelling costing about Nine Thousand Two Hundred and Fifty Dollars, with floor plans, specifications, sheet of details, etc.
2. Plate in Colors of a Dwelling erected near Wareham, Mass., at a cost of Twenty-eight Hundred Dollars, with full specifications, floor plans, sheet of details, etc.
3. The Shakespeare Memorial at Stratford-upon-Avon.
4. Perspective view and floor plans of a Residence to cost Eight Thousand Dollars.
5. Engravings of Five Tasteful Residences recently erected at Glenridge, N. J., varying in cost from Four Thousand to Six Thousand Five Hundred Dollars.
6. Perspective view, detail drawings, specifications, roof, and floor plans of a Two Thousand Five Hundred Dollar California House.
7. Engravings showing interior and front view of Chateau of Castelnaudary. M. Aubry, Architect.
8. Lea Hurst, Derbyshire, the home of Miss Florence Nightingale.
9. Elevations and floor plans of Homes of Factory Operatives at Willimantic, Conn.
10. Bathing House and Saloon at Vittel. Built by Charlies Garnier, Architect, of Paris.
11. Floor plans and perspective sketch for a Cottage costing about Five Thousand Five Hundred Dollars.
12. Perspective view and floor plans of a Cottage costing Four Thousand Two Hundred Dollars.
13. Front and rear perspectives, with plans, for a Handsome Stable being erected in Brooklyn, N. Y. Cost, Five Thousand Five Hundred Dollars.
14. Perspective view and floor plans of a Residence for Five Thousand Dollars.
15. Perspective view and plans of a Neat Dwelling costing Four Thousand Two Hundred Dollars.
16. Half page engraving of the John Crouse Memorial College for Women, Syracuse University, Syracuse, New York.
17. Plans for a French Cottage, Hotel de Peintre, Meudon.
18. Miscellaneous Contents: Optical Refinements in Architecture.—Testing Pile Protecting Compounds.—Our Forestry Problem.—Bamboo Tree.—Fire-proof Structures, illustrated.—Construction of Chimney Flues.—Roadside Plantations of Trees in Belgium.—An Egyptian Temple.—The White Ash.—Ornamental Keystones, three illustrations.—Sawdust, how Utilized.—Fire Bricks.—Improvements in Making Portland Cement.—Typhoid Fever Carried by Well Water.—An Unsafe Church.—Cedar Pavements.—Hemlock for Paving Purposes.—Collapse of Walls of Burning Buildings.—Relative Value of Wire and Cut Nails.—How to Build an Ice House.—Look to your Drain Pipes and Wells.—Arch Construction.—New Form of Chimes for Churches, illustrated.—Painting.—Removal of Chimneys.—The Back Yard.—Pine Woods.—Sketch of Thomas Ustick Walter.—Roburite, a New Explosive, with illustrations.—Iron Beams in Place of Wood.—Gangways v. Staircases.—How we have Grown.—A Great Building.—Proportions of Rooms.—How a Marble Statue is Made.—The Wainwright Horizontal Feed Water Heater, illustrated.—An Improved Double Surface Planer, illustrated.—How to Make a Cheerful Fireplace, illustrated.—The Sounding Board in St. Paul's Cathedral.—Gleason's Double Surface Planer, illustrated.—The Popular "Fortune" Hot Air Furnace, illustrated.—An Improved Hand and Foot Power Band Saw, illustrated.—Plants for Room Decoration.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richne , Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Castings for 2½″ × 3″ and 3½″ × 4″ vertical engines. Send for circular. F. W. Adams, Watertown, N. Y.

Situation Wanted—As foreman of iron foundry, making a specialty of fine castings, by "Yankee," of experience. A No. 1 references. Address box No. 7, Union City, Conn.

Drawings for mach'y and factories, buildings included. Indicator tests of steam and gas engines. Consultations. T. H. Muller, 319 B'dway, room 10, New York.

Wanted.—Manufacturers for perpetual calendar; all sizes; any material. Patent applied for. Address "Calwell House," White Sulphur Springs, W. Va.

Lacquers.—Zapon, Brilliantine, Brassoline, Opaline, and other lacquers and special varnishes. *Brilliant, hard, durable.* Send for catalogue. The Fred'k Crane Chemical Co., Short Hills, N. J. N. Y. agent, Horace Van Sands, 733 Broadway.

Paint mills. Chas. Kaestner & Co., Chicago, Ill.

Works by Huxley, Spencer, etc., fifteen cents. J. Fitzgerald, 24 E. 4th St., New York. Catalogue.

Wanted—A foreman for a foundry job shop. About 40 moulders employed. Address, stating age, reference, and salary expected, Foundry, box No. 3143, Boston, Mass.

Situation Wanted—By a man of experience as superintendent or foreman of iron foundry. References given. Address P. O. box 783, Providence, R. I.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Portable grinding mills. Chas. Kaestner & Co., Chicago, Ill.

Good agency wanted, mechanical or process. Muller & Sieghortner, 319 Broadway, room 10, New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Curtis Pressure Regulator and Steam Trap. See p. 364.

Pedestal tenoner. All kinds woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Chucks—over 100 different kinds and sizes in stock. Specials made to order. Cushman Chuck Co., Hartford, Ct.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1887 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Safety Elevators, steam and belt power; quick and smooth. D. Frisbie & Co., 112 Liberty St., New York.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 120 Liberty St., N. Y.

Feed grinders. Chas. Kaestner & Co., Chicago, Ill.

Pays well on Small Investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusements. 152 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Practical Working Drawings of machinery made by A. K. Mansfield & Co., 280 Broadway, N. Y. Lifelong mechanics. One formerly R. R. supt. M. P. Important references. Work guaranteed. Correspondence invited.

Woodworking machinery, planers, surfacers, matchers, beaders, etc. Rollstone Machine Co., Fitchburg, Mass.

Talcott's Wilson and combination belt hooks. Providence, R. I.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Engines and boilers. Chas. Kaestner & Co., Chicago, Ill.

Send for new and complete catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

NEW BOOKS AND PUBLICATIONS.

THE NEW ASTRONOMY. By Samuel Pierpont Langley, Ph.D., LL.D. Illustrated. Boston: Ticknor & Co. 1888.

This work is emphatically an *edition de luxe.* It is devoted to an attractive presentation of the recent work in the photographic, photometric, and spectroscopic branches of astronomical investigation. To these the author has given the name of the new astronomy, and

© 1887 SCIENTIFIC AMERICAN, INC.

he makes an earnest plea for assistance to be given to investigators in these lines. Our readers are already familiar with some of this class of work, from our description of Professor Pickering's work at the Harvard College observatory, and considerable space is given to the results of the Henry Draper memorial investigations in the book before us. The illustrations include solar and stellar studies, plates of spectra, and representations of lunar photographs. Some terrestrial views of the scenes in the mountains where the tireless observers were at work give a graphic idea of the hardships of the astronomer's field life. The paper is heavy, the margins are wide, and with its ornamental binding the book presents a most attractive appearance, and one quite in consonance with the holiday season.

CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS. Published by Henry Carey Baird & Co., 810 Walnut Street, Philadelphia, Pa., U. S. A.

We have received a copy of the above catalogue, which is devoted to the publications of this well known house. Space does not permit us to more than hint at its contents. It comprises a large assortment of standard works on technical subjects, and the principal works have a synopsis of the contents given, so that a buyer can order safely from the catalogue, knowing in advance whether what he is buying will be likely to suit his requirements. An "Index to Subjects" is a distinguishing feature that enhances the value of the catalogue. It is sent free of postage to all wishing it.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) N. B. D. asks: 1. How many gear wheels would make a good set for ordinary use on a small Barnes lathe, which I wish to convert from a hand feed to an automatic screw-cutting feed? How many teeth should the several wheels contain? A. For a small lathe for amateur work the screw should be 10 threads to an inch. If the screw has a left hand thread, it will require a 4 gear train. If a right hand thread, it will require a 5 gear train. The left hand screw and 5 gear train gives the best control of the distance between the centers of spindle and screw. The change can be made movable on a radius bar to accommodate the varying distance made by the different sizes of thread gear. The teeth should be about three-sixteenths inch pitch. The spindle, change gear, and inside stud gear may be 36 teeth. Then for outside stud gear and screw gear for—

	Stud gear.	Screw gear.
10 threads.	32	32 teeth.
12 "	40	48
14 "	40	56
16 "	20	32
18 "	20	36
20 "	20	40
22 "	20	44
24 "	20	48
26 "	20	52
28 "	20	56
30 "	20	60

2. Which would be the most economical and practical form of rotary engine—one of large diameter and short through shaft, or small diameter and greater length? Would not the first develop greater power at slower speed? Theoretically, the rotary engine would seem to be the best form of steam motor, as there are no dead centers and motion is continuous in one direction. Since steam can also be used expansively in this form of engine, what are the objections that prevent its more general use? A. No form of rotary engine has as yet been found to be economical when the factors of wear and waste of steam are considered. This is probably the secret of their scarcity in the list of steam engines on the market for practical and durable work. The large diameter rotary has narrow disks sweeping over large surfaces that are difficult to adjust to prevent leakage. The small diameter rotaries are the class that have mostly been adopted by builders of such engines.

(2) J. A. asks how he can make a magnet exert its magnetic attraction through 6 inches of metal—alternate layers of steel (hardened) and iron. A. This is practically impossible. The mass of iron distributes the magnetism so as to act as a magnetic shield.

(3) S. M. L.—The springs of steam gauges are made of seamless tubing flattened by drawing over a flat mandrel, and bent to the proper form after being filled with resin or fusible metal, the filling melted out, and the springs then burnished. They are generally made of an alloy of copper 1 pound, tin 1 ounce, zinc 4 ounces. Very small gauges have been made for special purposes, having springs 1½ to 2 inches diameter.

(4) J. B. asks a cure or, at least, a relief for chilblains. A. Dissolve 1 ounce ammonium chloride in ½ pint cider vinegar, and apply frequently: ½ pint alcohol may be added to this lotion with good effect.

(5) W. B. desires a receipt for making blackboard. A. Take ½ gallon shellac varnish, 5 ounces lampblack, 3 ounces powdered iron ore or emery. If too thick, thin with alcohol. Give three coats of the composition, allowing each to dry before putting on the next. The first may be of shellac and lampblack only. The Harvard liquid slating sold by paint houses is likewise an excellent preparation for this purpose.

(6) C. W. F. asks: 1. How can I make a good sticky fly paper? A. In a tin vessel melt together 1 pound resin and add 2 fluid drachms of linseed oil. While the mixture is warm dip a spatula into it and spread what adheres to the blade on foolscap paper. Different samples of resin require varying proportions of oil to make it spread properly. 2. What cement can I use to glue brass or steel to a thickly painted surface? A. No cement will make such a joint. 3. I have quite a quantity of tar, used for making gravel roofs. What can I mix it with to make a paint for shingles? A. Use coal tar benzol to dissolve or thin the tar.

(7) E. A. J. asks (1) how to make a strong parchment paper. A. Mix dilute strong sulphuric acid with ½ its volume of water and allow it to cool to about 65° Fah. Then immerse unsized paper in the cold acid for 10 to 50 seconds, according to its thickness. The paper is then well washed in cold running water, and dipped in dilute ammonia, again washed in water and finally dried. 2. How to make a good and cheap roofing paint—practically fire and water proof. A. Use the formula given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 113, under "Recipe for Roofing Paints."

(8) E. T. S. asks: 1. How can I give pine wood an ebony finish? A. Use the following: Dissolve 4 ounces shellac with 2 ounces borax in ½ gallon water. Boil until a perfect solution is obtained, then add ½ ounce glycerine, after which add sufficient aniline black (soluble in water), and it is ready for use. 2. How to crystallize glass so that it will not wash off. I have used salts and sour beer, but the least moisture destroys it. A. After you have allowed your salts to crystallize, thin-coat the glass with a light coat of varnish. Otherwise you must use the sand blast or some permanent method. 3. How to transfer any lithograph or printed picture of any kind on glass, so that it will be visible from both sides, and will last a long time? A. The process consists essentially in giving the warmed glass an even coating of balsam or negative varnish. Place the face of the print on the surface thus prepared, when the varnish is partly dry, but still tacky. Smooth it out and let it stand in a cool place until the varnish sets. Then apply water, and with a soft piece of gum rubber, or the finger tips, rub off the paper so as to leave the image on the varnished glass.

(9) C. P. S. asks (1) the point at which gasoline becomes a vapor or gas so that it can be burned. A. Gasoline is inflammable at the ordinary temperature, and can be burned. In using this as a gas, it is generally the habit to force air through a convenient vessel filled with shavings, saturated with gasoline, and as it comes out it may be ignited. 2. Can kerosene be burned as a gas? That is, what temperature must be applied? If it will form a gas in this way, is there any residue left in the tank? A. Kerosene has a burning point of 100° Fah., or upward, according to its quality. If properly burned, there will be no residue except carbon, same as in gas.

(10) W. S. desires a recipe for the padding glue so commonly used by printers throughout the country. A. Use a cheap glue, with five per cent glycerine, made into a mixture with any suitable coloring material. Some use ordinary rubber cement, made by dissolving rubber in carbon disulphide.

(11) A. G. M. asks how to clean kid gloves. A. Provide a tall glass cylinder, in the bottom of which place strong aqua ammonia. Be careful to remove from the sides of the jar any ammonia that may have been spattered upon them. Suspend the gloves to the stopper of the jar and allow them to remain for a day in the atmosphere of ammonia. They must not come in contact with the liquid. Rubbing with bread crumbs, in connection with the above, or without the use of ammonia, is also much practiced.

(12) L. S. C. asks the formula used in making oil coats (the light yellow ones worn by teamsters). A. As far as we can learn, the process consists simply in dipping the articles into boiled linseed oil. An excellent receipt is boiled oil 15 pounds, beeswax 1 pound, ground litharge 13 pounds. Mix and apply with a brush to the article, previously stretched against a wall or a table, first well washing and drying each article before applying the composition.

(13) H. G. H. asks for information on the following points concerning the construction of an induction coil, similar to the one described in SUPPLEMENT, No. 160, but 16 inches in length. What size of wire should be used for the primary coil? How many thicknesses of varnished paper should be placed between the layers of the secondary coil, the layers being wrapped entirely across the coil? A condenser of how many square feet should be used? How many cells bichromate of potash battery will best operate the coil? How long sparks ought such a coil to give? A. Use the same wire as specified in the article in SUPPLEMENT, No. 160, for a 16 inch induction coil. Put 60 to 80 square feet of tin foil in the condenser. Do not wind the wire all the way across the coil, but divide in four or more divisions. Use four or six bichromate cells. You should get 3 inch sparks.

(14) S. J. S. asks (1) a receipt for a dead black paint for photo. use and inside of optical instruments. A. For a dead black for inside of tubes use lampblack or artists' boneblack mixed with alcohol in which a few drops of shellac varnish have been mixed. No more shellac than will just make the black stick. Make a trial on a piece of metal. If, on drying, it shows the least shining surface, there is too much shellac. If, on the contrary, the black readily rubs off with the fingers, there is not enough shellac. A drop of shellac varnish to a tablespoonful of the mixture may change its drying character to a shining or a dead surface. As but a very small quantity of the blacking is needed for an instrument, we cannot readily give the precise quantity. 2. Can a wooden tray be coated with rubber so as to resist acids (chemicals used in photography)? If so, how? A. A wooden tray can be coated with rubber varnish and dried in an oven. We recommend paraffine as more suitable for chemicals. Warm the tray and send the paraffine well into the wood with a warm iron.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 6, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid of alpha-naphthol, monosulpho, A. Liebmann ... 374,259
Acids, apparatus for concentrating, Pischon & Pfennig ... 374,268
Anchor, folding, T. G. Edmondson ... 374,526
Animal catching device, W. Miller ... 374,488
Animal releasing device, Richards & French ... 374,321
Animal shears, J. W. Banner ... 374,233
Asparagus buncher, E. Watts ... 374,383
Auger, post hole, C. Linder ... 374,260
Autographic register, W. Assheton ... 374,231
Automatic brake, W. H. Thornton ... 374,379
Automatic gate, S. M. Williamson, Jr. ... 374,236
Ax, C. Maloney ... 374,483
Axle box, R. M. & C. F. Barrett ... 374,234
Axle skein, E. N. Hatcher ... 374,473
Axle, wagon, O. C. Hall ... 374,301
Axles, attachment for broken, T. Patton ... 374,200
Bag. See Mail bag.
Bag or satchel fastening, W. Roemer ... 374,324
Bag or satchel frame, W. Roemer ... 374,325
Balance swing, C. Schwager ... 374,206
Bale ties, machine for making wire, Lenox & Cook ... 374,308
Baling press, I. N. Cauthorn ... 374,450
Baling press, W. W. Seeley ... 374,207
Band cutter and feeder, J. H. Winslow ... 374,513
Bar. See Grate bar.
Barrel firing apparatus, W. S. Wymond ... 374,570
Barrel head and fastening, R. C. Boekler ... 374,446
Basin cover, catch, G. G. Campbell ... 374,393
Battery. See Galvanic battery.
Bed stay, C. Bethea ... 374,443
Bell for car horses, W. Scarffe ... 374,326
Bicycle step, T. Benfield ... 374,287
Bit. See Bridle bit.
Bit stock, W. B. Gilmore ... 374,185
Blacking box, C. N. Willis ... 374,282
Blast furnaces, apparatus for heating blasts for, W. B. Beveridge ... 374,240
Blinds, lift for sliding, H. E. Willer ... 374,385
Blinds, receptacle for sliding window, H. E. Willer ... 374,384
Blower for stoves or grates, O. J. Buckus ... 374,334
Boat. See Ice breaking boat.
Boiler cleaner, Smith & Meiklejohn ... 374,502
Bolt. See Flour bolt.
Bolt, F. T. Cladek ... 374,451
Bolt, E. F. W. Zarbock ... 374,229
Books, page fastener for, W. I. Winne ... 374,386
Boot and manufacture of same, fabric, M. V. Beiger ... 374,338
Boot and shoe heels, rotary cutter for trimming, W. Manley ... 374,418
Boots or shoe heels, machine for forming, E. Jones ... 374,536
Boot or shoe tree, S. Mawhinney ... 374,311
Boots, etc., stretcher for felt or fabric, A. Eberhart ... 374,353
Boots or shoes, cutter head for, W. Manley ... 374,416
Boring machine, wood, H. Ihsen ... 374,363
Boring tool, C. A. Simmons ... 374,432
Bottle caps, machine for clinching, A. L. Bernardin ... 374,517
Bottles caps, machine for forming sheet metal, W. H. Northall ... 374,553
Bottle stopper, J. McInnes ... 374,263
Box. See Axle box. Blacking box. Fare box. Music box. Tree box.
Bracket. See Curtain pole bracket.
Brake. See Automatic brake. Cornice brake. Vehicle brake. Wagon brake.
Brake shoe, J. Pollock ... 374,427
Brake shoe, G. M. Sargent ... 374,272, 374,273
Brick drying kiln and car to be used therein, J. R. Kemp ... 374,540
Bridge gate, draw, Fracher & Hoyt ... 374,356
Bridge gate, swinging, C. Von der Muhlen ... 374,435
Bridle bit, L. F. Dean ... 374,352
Briquettes, manufacture of, J. J. Saltery ... 374,560
Brush, contact, E. L. Orcutt ... 374,198
Brush or mop holder, M. Bourke ... 374,171
Buckle, D. A. Gilbert ... 374,470
Buckle, D. L. Smith ... 374,377
Bustle, V. H. Buschmann ... 374,519
Bustle, W. A. Dotey ... 374,180
Bustle, T. P. Taylor ... 374,214, 374,216
Button, H. Gray ... 374,583
Button, E. L. Lambert ... 374,258
Button, collar, W. Scott ... 374,429
Button or stud, B. Lyon ... 374,366
Can, H. E. Tiepke ... 374,380
Car coupling, J. W. Dillon ... 374,459
Car coupling, J. D. Keith ... 374,257
Car heater, R. B. Cuthbert ... 374,522
Car heater, railway, W. C. Baker ... 374,336
Car heating apparatus, J. H. Sewall ... 374,275
Car roof, A. P. Le Gros ... 374,545
Car step, railway, Vincent & Cairns ... 374,217
Carpet fastener, R. S. Grummon ... 374,534
Carrier. See Shaft carrier.
Carrier, J. A. Jeffrey ... 374,477
Cart, dump, J. G. Frogner ... 374,531
Case. See Clock case. Pencil case.
Caster, truck or furniture, S. M. Michelson ... 374,420
Chair. See Opera chair.
Chair, S. Hayward ... 374,250, 374,251
Charts, device for exhibiting school, J. D. McMeen ... 374,486
Check rower, grain planter, and cultivator, combined, J. W. Doyle ... 374,460
Chuck, lathe, F. L. Gregory ... 374,405
Chute, dust, W. McHose ... 374,197
Clamp. See Miter clamp.
Cleaner. See Boiler cleaner.
Clock case, A. Bannatyne ... 374,516
Clod crusher and harrow, J. H. Wyatt ... 374,569
Clod crusher, harrow, and weed cutter, combined, Donoho & Gates ... 374,178
Clothes reel, portable, F. & A. F. Slooter ... 374,376
Cock, valve, J. Hurt ... 374,188
Coffee or tea pot and urn, L. J. Richards ... 374,270
Coin bags, sealing, C. A. Judd ... 374,255
Collar and bame, horse, J. & J. G. Wainwright ... 374,328
Collars and other articles, manufacturing horse, A. B. Coleman ... 374,452
Cornice brake and shearing machine, combined, G. C. Keene ... 374,306
Corset, M. P. Bray ... 374,392
Corset fastening, L. Hill ... 374,407
Corsey stay, T. P. & A. Taylor ... 374,215
Cotton gin rib, H. W. Libbey ... 374,193
Cotton scraper, B. C. Jinnett ... 374,254
Coupling. See Car coupling. Evener coupling. Pipe coupling. Thill coupling. Tube coupling.
Crib, child's, E. W. Smith ... 374,277
Crusher. See Clod crusher.
Cue tip, H. Story ... 374,327
Cultivator, F. C. Geiger ... 374,469
Cultivator, disk, A. Spire ... 374,503
Cultivator, walking, J. H. Jones ... 374,538
Curtain pole bracket, R. Brass ... 374,340
Cut-off for water supply pipes, J. A. Adams ... 374,162
Cutter. See Band cutter. Meat cutter. Rod cutter. Rotary cutter.
Dam and reservoir construction, H. W. R. Strong 374,378
Dental engine, A. Weber ... 374,221
Dental engine, electrical, G. W. Whitefield ... 374,225
Dental engines, hand piece for, Bell & Marsh ... 374,286
Digger. See Post hole digger.
Door, adjustable screen, W. Hughes ... 374,187
Door check, F. L. Becker ... 374,337
Door check, G. Geer ... 374,245
Door check, J. P. & J. H. Swift ... 374,563
Doors or gates, apparatus for opening and closing, C. P. Niles ... 374,552
Doubletree, J. R. Freeland ... 374,468
Dredging machine, C. C. Sullivan ... 374,506
Dress shield, L. Bryarly ... 374,172
Drier, C. F. B. Caspari ... 374,520
Drill. See Grain drill.
Drilling machine attachment, W. Evans ... 374,181
Drum, heating, J. W. Yates ... 374,284
Drum or spark arrester, heating, U. J. Wakeman. 374,436
Drums, lid for metallic, J. Simpson ... 374,276
Dyeing, E. Rau ... 374,320
Edge setting machine, P. McLaughlin ... 374,314
Egg safe, D. B. Smith ... 374,210
Electric current regulator, S. D. Field ... 374,404
Electric distribution, system of, M. Waddell ... 374,381
Electric generators, regulation of, D. Higham ... 374,406
Electric wires, underground system for, J. P. Davis ... 374,458
Electrical conductors, underground conduit for, G. W. Cook ... 374,348
Elevator stop, F. C. Cannon ... 374,396
Embossing paper, wood, etc., machine for, J. P. Jamison ... 374,253
Engine. See Dental engine. Portable engine. Rotary engine. Steam engine.
Engine signal, J. C. Ricketson ... 374,139
Engines, device for lighting steam, C. E. Barnes ... 374,168
Engraving machine, Ourdan & Kolb ... 374,492
Envelope machine, O. E. Davidson ... 374,523
Evener coupling for vehicle poles, W. J. Edwards ... 374,294
Exercising machine, R. Reach ... 374,496
Expansion joint, J. N. Pew ... 374,371
Eyeglasses, manufacture of blanks for, H. Lenfant ... 374,546
Fare box, G. H. Goodrich ... 374,471
Faucet apparatus, W. A. Babcock ... 374,232
Fence machine, A. J. Neal ... 374,550
Fence machine, J. C. Riddle ... 374,497
Fence posts, manufacture of, J. W. Griswold ... 374,299
Fences, staypiece or guard for wire, S. F. Duncan 374,461
Fertilizer distributer, E. J. Corser ... 374,453
Fertilizer drills, hopper for, T. R. Crane ... 374,455
File, paper, J. M. D. France ... 374,467
Firearms, telescopic sight for, R. C. Rice ... 374,202
Fire escape, J. Fisher ... 374,244
Fire extinguisher for railway cars, P. Smith ... 374,211
Fishing-reel, E. B. Porter ... 374,319
Flour bolt, O. M. Morse ... 374,490
Flour bolt, Smith & Cochrane ... 374,500, 374,501
Forcing frame, J. Siem ... 374,499
Fork. See Velocipede fork.
Frame. See Bag or satchel frame. Forcing frame. Slate frame.
Fruit picker, S. Shroyer ... 374,375
Furnace. See Plumber's or tinner's furnace. Smoke consuming furnace.
Furnace, R. D. Baldwin *et al* ... 374,285
Furnace door, W. Kearney ... 374,190
Galvanic battery, F. J. Crouch ... 374,456
Galvanic battery, H. E. Waite ... 374,329
Gas governor, L. P. Blair ... 374,445
Gas lighter, electric, J. B. Entz ... 374,528
Gas pressure regulator and cut-off, O. J. McGann. 374,485
Gate. See Automatic gate. Bridge gate.
Girder or arch, C. H. Rodemer ... 374,271
Governor, electric, W. H. Reynolds ... 374,374
Grain binder, W. M. Piatt ... 374,267
Grain binder, G. H. Spaulding ... 374,434
Grain binders, trip mechanism for, J. P. Bullock ... 374,341
Grain drill, W. D. Arnett ... 374,514
Grain drills, feed device for, T. R. Crane ... 374,454
Grate, F. H. De Guerre ... 374,176
Grate bar, W. E. Kelly ... 374,411
Hair curler, J. Gregory ... 374,246
Hair tonic, J. S. Moore ... 374,489
Hammock, T. H. Hartman ... 374,472
Handle, G. Fitzsimmons ... 374,466
Harness, A. Sherwood ... 374,430, 374,431
Harness fastening loop, J. Detrick ... 374,177
Harness mounting, E. R. Cahoone ... 374,344
Harness neck pad, J. W. Johnson ... 374,189
Harvester, G. Chapman ... 374,521
Harvesters, sheaf discharger for grain binding, M. M. Hooton ... 374,302
Hat pouncing tool, Taylor & Scovill ... 374,212
Hatchways, means for operating elevator, F. K. Fassett ... 374,243
Hay sling, J. Law ... 374,192
Header and thrasher, combined steam traction, J. S. Berry ... 374,339
Heat, apparatus for generating, W. W. Dashiell. 374,350, 374,351
Heat energy into electrical energy, apparatus for converting, W. E. Case ... 374,173
Heater. See Car heater.
Heating dwelling rooms, public buildings, etc., apparatus for, E. S. Bassett ... 374,235

© 1887 SCIENTIFIC AMERICAN, INC.

Heel mould, A. L. F. Mitchell 374,368
Heel stiffener machine, G. A. Knox 374,414
Heel trimming machine, W. Manley 374,419
Hides, apparatus for stretching, J. Young 374,228
Hoisting apparatus, P. G. Backman 374,442
Holder. See Brush or mop holder. Label holder. Sash holder.
Holder for labels, checks, and the like, H. Thum. 374,509
Horse power, G. Hadenfeldt 374,186
Horseshoe nail finishing machine, H. E. Woodford 374,227
Horseshoe, sectional, J. Curtin 374,298
Ice breaking boat, W. R. Schooley 374,205
Indicator. See Station indicator.
Induction coil, coin operated, W. R. Pope 374,495
Iron. See Wagon body iron.
Iron and steel, reheating, H. Roberts 374,558
Jib hank, T. O. Jameson 374,476
Joint. See Expansion joint. Rail joint. Universal flexible joint.
Jug cover, E. A. Brownfield 374,238
Kiln. See Brick drying kiln.
Knitted undergarment, J. Persch 374,494
Knitting machine, circular, M. Marshall 374,196
Knitting machine, straight, R. Emerson 374,527
Knitting machines, spring for sinkers of, E. Tiffany 374,280
Label holder, E. A. Cannon 374,395
Ladder, extension, Sibley & Allen 374,561
Lamp extinguisher for railway cars, A. H. Marden 374,548
Lamp, incandescent electric, M. Wheeler 374,224
Lamp suspending devices, balancing attachment for automatic, N. Jenkins 374,475
Last, H. Stockman 374,504
Last and last standard, W. S. Thayer 374,564
Lead or base bullion from slag, mattes, and speiss, apparatus for separating, W. B. Devereux 374,239
Leather splitting machine, G. Faustmann 374,401
Letter sheet and envelope, combined, Proeschel & McClintock 374,555
Lock. See Nut lock. Switch and signal lock.
Lock, W. D. Doremus 374,179
Machine starting device, Damon & Griswold 374,349
Mail bag, Haines & Breidenbach 374,300
Mail bag, W. Roemer 374,323
Meat cutter, O. D. Woodruff 374,568
Mechanical movement, A. Nelson 374,423
Medical compound for asthma, etc, D. G. Nichols. 374,491
Meter. See Piston meter. Water meter.
Middlings purifier, Barnard & Cornwall 374,388
Miter clamp, Miller & Berg 374,264
Mould. See Heel mould.
Moulding machine, sand, S. J. Adams 374,163
Motion, device for transmitting, G. F. Evans 374,296
Motor. See Music box motor.
Music box, L. Campiche 374,394
Music box motor, C. H. Jacot 374,410
Nail. See Shoe nail.
Nail, H. F. Murray 374,549
Nail assorting machine, E. B. Allen 374,387
Nail set, R. H. Hunter 374,252
Nut lock, Parks & Roquemore 374,426
Nut lock, A. Schapiro 374,274
Oil burning attachment, W. Snyder 374,433
Oil compound, resin, D. J. Ogilvy 374,370
Opera chair, W. Y. Ober 374,424
Oven door, H. Born 374,391
Oyster tongs, C. L. Marsh 374,195
Pad. See Harness neck pad.
Paint, T. Munson 374,266
Paper bag machine, E. E. Claussen 374,345
Paper bag machine, W. H. Honiss 374,361
Paper bag machine, Lorenz & Honiss 374,309
Paper fixture, toilet, J. T. & W. J. Donovan 374,399
Paper lining machine, A. Segal 374,498
Paper mills, device for cleaning the shower pipes used in, G. H. Boorn 374,290
Paper receptacle, O. H. Hicks 374,474, 374,475
Pencil case, G. W. Mabie 374,494
Perfume, coin operated mechanism for delivering a spray of, E. G. Colton 374,347
Phosphates, making acid potassium, C. V. Petraeus 374,201
Photograph burnisher, W. G. C. Kimball 374,412
Piano action, A. Battes 374,389
Picker. See Fruit picker.
Pipe coupling, S. H. Barrett 374,169
Pipes, machine for making soft metal, J. C. Appleby 374,165
Pipes, means for making, J. C. Appleby 374,167
Piston meter, M. P. Freeman 374,530
Pitman, E. W. Cady 374,449
Planing machine, A. McHenry 374,313
Planing machine, Woods & Thomas 374,283
Plant protector, W. R. Hallock 374,302
Planter, D. M. Parry 374,316
Planter, corn, Drake & Linder 374,242
Planter, corn, D. R. Vivion 374,218
Planting machine, corn, J. H. Jones 374,537
Plow, M. J. Todd 374,565
Plow and planter, combined, A. Lindgren 374,415
Plumber's or tinner's furnace, Z. Davis 374,398
Pocktbooks, etc., frame for, L. Messer 374,487
Portable engine, A. Pifre 374,318
Post hole digger, J. H. Humphrey 374,304
Postal packet, H. A. Robinson 374,204
Pot. See Coffee or tea pot.
Pouncing machine, F. C. Taylor 374,213
Power. See Horse power.
Press. See Baling press.
Printing maching, rotary, J. L. Firm 374,355
Printing machines, sheet delivery apparatus for, for, G. P. Fenner 374,465
Propelling vessels by air or gas, apparatus for, P. Haenlein 374,247
Pulley, split, W. A. Moore 374,421
Pulp for the manufacture of refrigerators and making the same, wood, C. B. Gardner 374,183
Pulp machine, C. B. Gardner 374,182
Pump, R. H. Aldrich 374,332
Pump, double-acting force, L. C. Farmer 374,400
Pump, motor, blow, or exhauster, rotary, F. T. Adams 374,331
Punch, screw, J. Farrin 374,464
Punch, ticket bell, J. M. Black 374,288
Radiator, Q. S. Backus 374,333
Radiator, R. F. Brown 374,518
Radiator, C. E. Hitchings 374,360
Rail joint, G. J. Ferguson 374,529
Railway crossing, street, A. J. Moxham 374,265
Railway danger signal, Quinn & Crossley 374,373
Railway, electric, E. M. Bentley 374,236
Railway frog, A. A. Strom 374,505
Railways, conduit for cable or electric, W. Nier 374,315
Railways, rail connection for electric, E. L. Orcutt 374,199
Rake teeth, machine for pointing, E. P. Burns 374,342
Reapers, cutter mechanism for, L. W. Clark 374,397
Reel. See Clothes reel. Fishing reel.
Refrigerator, C. B. Gardner 374,364
Register. See Autographic register.
Regulator. See Electric current regulator. Gas pressure regulator.
Respiration, apparatus for producing artificial, G. E. Fell 374,402
Rod cutter, J. Klein 374,480
Rolling machine, metal, Bagaley & Hainsworth 374,335
Rope trip, H. Mapes 374,261
Ropes, etc., and preventing twisting or kinking thereof while being paid from a coil, coiling, W. S. Sims 374,209
Rotary cutter, W. Manley 374,417
Rotary engine, E. H. Kruger 374,543
Rugs, etc., machine for wrapping strips for use in the manufacture of, G. F. Brinkerhoff 374,448
Ruler, parallel, H. J. Eisen 374,462
Safes, finishing and ornamenting, J. White 374,567
Sail hank, stay, J. O. Wikman 374,230
Salt cellar, M. Thomson 374,508
Sash holder, F. H. Jury 374,256
Sawmill set works, W. B. Willet 374,511
Scaffold, portable, A. Lapointe 374,481
Scaffolding, W. S. Welch 374,510
Scissors or shears, C. Hamann 374,358
Screens, machine for making wire, A. F. Caldwell 374,291
Sealing packages, apparatus for, A. J. Phelps 374,372
Steam pressing machine, Fellows & Busfield 374,404
Seed crushing machine, cotton, H. S. Taylor 374,507
Seed drills, fertilizer attachment for, R. A. McLeod 374,367
Seeding machine, J. H. Jones 374,539
Sewing bags, machine for, W. H. Kerr 374,541
Sewing looped fabrics, machine for, A. Nelson 374,422
Sewing machine buttonhole attchment, A. W. Johnson 374,479
Sewing machine feed reversing mechanism, W. A. Neely 374,551
Sewing machines, trimming attachment for, C. H. Willcox 374,440
Shaft carrier, V. W. A. Richards 374,203
Shaft connection, crank, A. L. Center 374,174
Shears. See Animal shears.
Sheet metal, ornamentation of, F. Rudolph 374,559
Shell capper and extractor, P. A. Lee 374,482
Shoe, Balcom & Allen, Jr 374,515
Shoe nail, E. E. Dow 374,524
Shoe sole plate, C. Williams 374,512
Signal. See Engine signal. Railway danger signal.
Slate frame, writing, O. J. Owen 374,554
Sled propeller, F. Robbin 374,428
Smoke consuming furnace, C. E. Davis 374,457
Spark arrester, J. H. Swartzbaugh 374,562
Spring. See Watch case spring.
Staking tool, A. M. Lane 374,365
Stall, swinging stable, A. V. Hartle 374,249
Stand. See See Switch stand.
Starch, apparatus for cooking, H. A. Coats 374,346
Station indicator, automatic, C. W. May 374,484
Stave jointing and planing machine, C. R. Penfield 374,317
Steam engine. J. Ericsson 374,354
Stereotype matrices, machine for making, J. H. White 374,438
Stocking and knitting the same, J. H. Hinchliffe 374,408
Stool, piano, C. E. Davis 374,175
Stopper. See Bottle stopper.
Store service apparatus, C. W. Elliott 374,295
Stove, R. A. Rew 374,556
Stove grate, J. C. Kohler 374,413
Stoves, oven for vapor, G. M. Voltz 374,219
Strap loop and bag fastening, C. Reinisch (r) 10,887
Switch and signal lock, I. May 374,512
Switch stand, W. A. Redding 374,269
Switch stand, F. C. Weir 374,437
Telegraph, printing, A. Bixby 374,444
Telegraph transmitter, A. Bixby 374,390
Tellurian, W. L. Holden 374,409
Templet for use in gaining stair stringers, W. H. Parry 374,493
Tenoning machine, L. F. Parks 374,425
Thill coupling, W. C. Burrows 374,343
Thill coupling, C. Twombly 374,566
Tools to their handles, device for securing edged, T. H. Neal 374,369
Tooth crowns, instrument for forming, H. W. Watkins 374,382
Transmitter, Whitney & Pultz 374,439
Tree. See Boot or shoe tree. Doubletree.
Tree box, metallic, W. F. Benedict 374,170
Trnck, locomotive, J. Johnston 374,305
Tube coupling, G. N. Riley 374,557
Turntable guide, A. V. Du Pont 374,525
Undergarment, combination, W. F. Kneip 374,307
Universal flexible joint for pipes, F. G. Botsford 374,447
Valve, R. M. Lafferty 374,544
Valve, balanced, W. F. Berry 374,237
Valve gear, H. F. Gaskill 374,298
Valve, slide, G. Bonker 374,289
Valve, slide, L. Engebretsen 374,463
Vehicle, Apple & Brandon 374,441
Vehicle brake, S. W. Albertson 374,230
Velocipede fork, J. Knous 374,542
Vending apparatus, automatic, P. Everitt 374,297
Vessels, bottom scraperfor, T. Thorsen 374,279
Wagon body, E. Wells 374,222
Wagon body iron, E. Wells 374,223
Wagon brake, C. W. Loomis 374,547
Wagon, spring, H. M. Stoddard 374,278
Watch case spring, A. Humbert 374,535
Watches and clocks, mainspring brace and fastener for, C. T. Higginbotham 374,359
Water closets, flushing apparatus for, P. J. Madden 374,310
Water meter, piston, J. Dooling 374,241
Weather strip, I. Martin 374,262
Weigher, automatic grain, E. A. Hoover 374,362
Well drilling machine, D. J. Culy 374,292
Whips, etc., machine for setting caps on, F. L. Goodenough 374,532
Wire lapping tool, F. W. Koblentz 374,191
Wire netting, reel for holding, Geiger & Wood 374,357
Wire with soft metal, apparatus for covering, J. C. Appleby 374,164, 374,166
Wood, preserving, J. A. Sewall 374,208
Yoke and tongue tip, neck, A. V. Hartle 374,248
Yoke, pole, E. Walter 374,220

DESIGNS.

Badge or medal, J. W. Maxcy 17,920
Badge or picture frame, C. A. Breckenridge 17,918
Burial casket, L. Stein 17,928
Carpet, C. F. Gedney 17,930
Carpet, H. Horan ..... 17,931 to 17,933
Carpet, J. McMann 17,934
Carpet, E. G. Sauer 17,936, 17,937
Carpet, J. Wishart 17,929
Costume, lady's, E. Moran 17,926
Fabric, J. Z. Coblens 17,919
Lamp fixture, hanging, A. Patitz 17,927
Oil cloth, C. T. & V. E. Meyer ..... 17,921 to 17,925
Tea kettle stand, W. T. Mersereau 17,935

TRADE MARKS.

Cigars, cigarettes, chewing and smoking tobacco, and snuff, Pemberton & Hill Tobacco Manufacturing Company 15,001
Colic and spavin cure, worm, cough, and condition powders, cough tea, plasters, and pills, Wm. Gausewitz & Co 15,008
Cotton, six cord spool, Willimantic Linen Company 15,004
Garments for men and boys, Solidity Co-operative Clothing Company 15,012
Glue, Samson Manufacturing Co 15,003
Guano, R. A. Wooldridge & Co 15,010
Gum, chewing, W. J. White 15,009
Harness and saddles, chaperejos, saddle bags, fenders, housings, bridles, and horse blankets, Becker & Leonard 14,994
Ink, gelatinized paper, and the accessories for hectograph copying, and a kit for working the same, F. W. Zimmer 15,011
Lamps, candle holders, candles, and night lights, S. Clarke 14,996
Mineral water, its salts and constituents, and all compounds containing said water, salts, or constituents, natural, Apollinaris Company 15,006
Mineral water, natural, Apollinaris Company 15,005
Mineral water, soda water, kali water, and ginger ale, artificial, Carbonated Beverage Co 15,007
Nuts, Bennett, Day & Co 14,995
Ointment, W. H. Cornell 14,997
Plasters, H. S. Johnston 14,998
Ribbons, Abegg, Daeniker & Co 14,993
Rubber belting, hose, and packing, Revere Rubber Company 15,002
Soup for human use, F. King & Company 14,999
Washing compound, liquid, C. W. Link, Jr 15,000

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisement at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

MACALISTER & BARTLETT,
SUCCESSORS TO
GEO. W. READ & CO.
300 LEWIS ST., NEW YORK
Manufacturers of and Dealers in
HARDWOOD LUMBER & VENEERS,
Fancy Woods and Designs for Scroll Sawing.
Send 2c. stamp for Catalogue.

WANTED A Practical Mechanic with $5,000 to $15,000 as Partner in a Foundry and Machine Shop, or will sell whole interest on easy terms. JOHN C. KILNER, York, Neb.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29. ST. NEW YORK CITY

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical. 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. L. MANASSE, 88 Madison Street, Chicago, Ill.

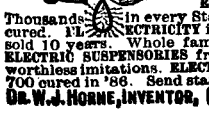
VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

FAC-SIMILE copies obtained to an unlimited extent in indelible black by the
ECLIPSE copying apparatus, equal to the finest lithographic work. Specimens free.
FELIX F. DAUS & CO., 21 Beekman Street, New York.

TO AMERICAN MANUFACTURERS
Wishing to open business with India, please send price lists of real aluminum gold jewellery, and all sorts of fancy goods, curiosities, and latest novelties, scientific instruments, and toys, etc., to M. KANE & COMPANY, 134 Kalkadevo Road, Bombay.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. **Vacuum Pumps** of the highest efficiency. **Filter Press Pumps.** Air, Gas and Acid Blowers. **Air Compressors.** Etc.
BUILT BY GUILD & GARRISON, Brooklyn, N. Y.

EXCELLENT BLACK COPIES of *anything written* or *drawn* with *any* Pen (or Type Writer) by the Patent
AUTOCOPYIST Only equaled by Lithography. Specimens Free.
AUTOCOPYIST CO., 166 William Street, New York.

WEAK, NERVOUS PEOPLE


And others suffering with rheumatism, neuralgia, kidney and exhausting chronic diseases, premature decline of young or old are positively cured by Dr. Horne's famous ELECTRO-MAGNETIC BELT. Thousands in every State in the Union have been cured. ELECTRICITY instantly felt. Patented and sold 10 years. Whole family can wear the same belt. ELECTRIC SUSPENSORIES free with male belts. Avoid worthless imitations. ELECTRIC TRUSSES FOR RUPTURE. 700 cured in '86. Send stamp for pamphlet.
DR. W. J. HORNE, INVENTOR, 191 WABASH AV., CHICAGO.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
LATHES Foot & Power

Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application
165 W. 2d St., Cincinnati, O.

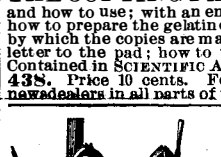
THE MODERN ICE YACHT. — BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 624. Price 10 cents. To be had at this office and of all newsdealers.

ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue.
Pierce Well Excavator Co. New York.

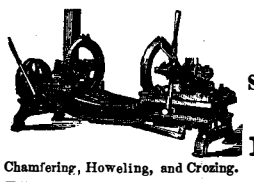
AN IMPROVED ARMY FILTER —DEscription of a very effective portable filter, devised by Mr. Maignen for army use, but likewise adapted for the use of wine and spirit merchants and brewers, and for laboratory purposes. Illustrated with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 436. Price 10 cents. To be had at this office and from all newsdealers.

Barnes' Foot-Power Machinery.
Complete outfits for Actual Worksnop Business. Read what a customer says: "Considering its capacity and the accurateness of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day and at night feel as little tired as if I had been walking around." Descriptive Catalogue and Price List Free. W. F. & JOHN BARNES Co. Address 1999 Main St., Rockford, Ill.

ORNAMENTAL DESIGN, PRINCIples and practice of.—By Lewis F. Day. The second of a series of lectures on this subject, discussing the lines upon which ornament can be distributed. With 5 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 589. Price 10 cents. To be had at this office and from all newsdealers.

LATHES For Cutting Irregular Forms Such as Axe Handles, etc., A Specialty.

Barrel Hoop and Basket Machines, Veneer Cutting Machines, Handle and Nulling Lathes, Milling, Mortising, Gear, and Key Seat Cutting Machines, Stave, Heading, and Shingle Machines.
MANUFACTURED BY THE
I. E. MERRITT MACH'Y CO., Lockport, N. Y., U. S. A.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.


BARREL, KEG, Hogshead, AND STAVE MACHINERY.
Over 50 varieties manufactured by
E. & B. HOLMES,
Chamfering, Howeling, and Crozing. BUFFALO, N. Y.

ELECTRIC WELDING.—A PAPER BY Prof. Elihu Thomson, giving an account of a new way of utilizing the heating effects of heavy electrical currents for causing union between pieces of metal, whether of the same or of different kinds. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

SCIENTIFIC BOOK CATALOGUE,
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

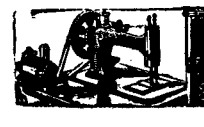
2d HAND MACHINERY Lists sent. N.Y. Machinery Depot, Bridge Store No. 16, Frankfort Street, N. Y.

OIL, LIME and ELECTRIC LICHT
Best Plain or Colored LANTERN SLIDES.
L. J. MARCY, 1604 CHESTNUT ST., PHILADELPHIA.

To Business Men.
The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.
For rates see top of first column of this page, or address
MUNN & CO., Publishers,
361 Broadway, New York.

Syracuse Malleable Iron Works

GAS ENGINEERING, RECENT PROgress in.—By A. Macpherson. Regenerative system of retort firing. Improvements in gas purification. Burners and regenerative lamps. The Welsbach gas light, Paraffin as a rival of coal gas, oil in gas making. Prices of residual products. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 601. Price 10 cents. To be had at this office and from all newsdealers.



© 1887 SCIENTIFIC AMERICAN, INC.

STANDARD WORKS
—ON—
Electricity.

Electricity in the Service of Man.

A popular and practical treatise on the applications of Electricity in Modern Life. Translated and Edited, with Copious Additions, from the German of Dr. Alfred Ritter Von Urbanitzky. By R. Wormell, D.Sc., M.A. 1,096 pages, fully illustrated, med. 8vo, cloth. $6.00.

"No richer work than this on the applications of electricity to modern life has ever appeared. It amounts to a cyclopedia of its kind. While the book is in the highest degree scientific—and as such perfectly adapted to the wants of all earnest students of the subject—it is also popular in its form and style. Its (nearly) 850 illustrations, beautifully engraved, are a strong extra recommendation of its contents to the general reader."—*Journal of Commerce.*

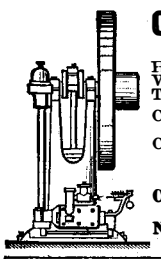
THE ELECTRICIAN'S POCKETBOOK.

Being a translation of Hospitalier's "Formulaire Pratique de l'Electricien." With additions by Gordon Wigan, M.A., Barrister-at-Law, Member of the Society of Telegraph Engineers and Electricians. (A sheet of specially ruled paper for electrician calculation is included in this volume.) Crown 8vo, cloth. $2.00.

PRACTICAL ELECTRICITY.

A Laboratory and Lecture Course for First Year Students of Electrical Engineering. Based on the Practical Definitions of the Electrical Units. By W. E. Ayrton, F.R.S., Asso. Mem. Inst. C. E., Professor of Applied Physics at the City and Guilds of London, Central Institution; with numerous illustrations. 1 vol., 12mo, extra cloth. Price $2.50.

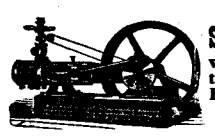
CASSELL & COMPANY, Limited,
739 & 741 Broadway, N. Y.



OTTO GAS ENGINES.
Over 25,000 Sold.

Horizontal .....Otto ..Gas Engines.
Vertical.....Otto....Gas Engines.
Twin Cylinder..Otto....Gas Engines.
Combined.....Otto..{Gas Engines and Pumps.
Combined.....Otto..{Gas Engines and Dynamos

OTTO GAS ENGINE WORKS,
CHICAGO, PHILADELPHIA.
New York Agency, 18 Vesey Street.



SUPERIOR
Stationary Engines
with Plain and Automatic Cut-off. Vertical and Horizontal.
Penna. Diamond Drill Co., Birdsboro, Pa.

Established by EDWARD L. YOUMANS.

THE Popular Science Monthly.

EDITED BY W. J. YOUMANS.

Is filled with scientific articles by well known writers on subjects of popular and practical interest. Its range of topics, which is widening with the advance of science, comprises: Domestic and Social Economy; Political Science, or the Functions of Government; Pyschology and Education; Relations of Science and Religion; Conditions of Health and Prevention of Disease; Art and Architecture in Practical Life; Race Development; Agriculture and Food Products; Natural History; Exploration; Discovery, etc.

In volume XXXII, which begins with the number for November, 1887, Professor Joseph Le Conte will discuss the Relations of Evolution and Religion, and the Hon. David A. Wells will continue his valuable papers on Recent Economic Disturbances. The volume will also contain illustrated articles on Astronomy, Geography, Anthropology, Natural History, and the Applications of Science; and will be enriched with contributions by Professors J. S. Newberry, F. W. Clarke. N. S. Shaler, Mr. Grant Allen, Mr. Appleton Morgan, and other distinguished writers.

It contains Illustrated Articles, Portraits, Biographical Sketches; records the advance made in every branch of science; is not technical; and is intended for non-scientific as well as scientific readers.

No magazine in the world contains papers of a more instructive and at the same time of a more interesting character.

D. APPLETON & CO.,
1, 3 & 5 BOND STREET,
NEW YORK.

Single Number 50 cents.
Yearly Subscription, $5.00.

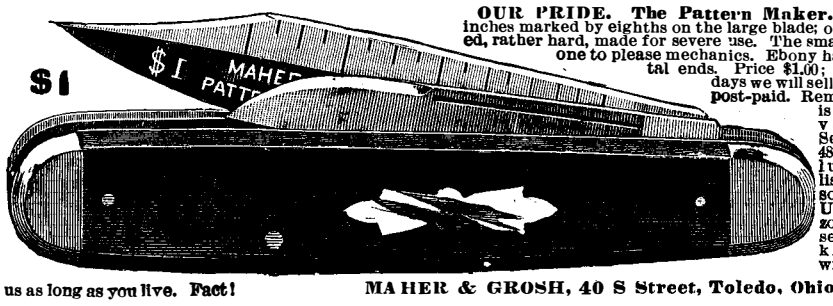
2000 Fine Black copies of Writing, Drawing, Music.
FAST AUTOMATIC COPIER
Works automatically with wonderful precision and rapidity.
FAST AUTOMATIC CO., 2 New Chambers St., N. Y.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

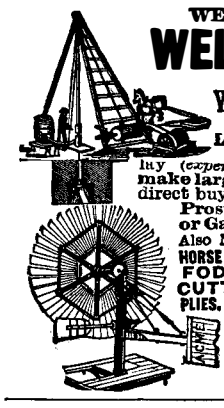
CONSUMPTION, throat and bronchial troubles Cured.
A late discovery. Sample bottles free with treatise containing directions for home treatment. Give express office.
DR. WM. F. G. NOETLING & CO., East Hampton, Conn.

PIPE COVERINGS
Made entirely of ASBESTOS.
Absolutely Fire Proof.
BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y.
BRANCHES: Phila, 34 S. 2d St. Chicago, 144-146 E. Lake St. Pittsburg, 37 Lewis Block.



OUR PRIDE. The Pattern Maker. Has two inches marked by eighths on the large blade; oil-tempered, rather hard, made for severe use. The small blade is one to please mechanics. Ebony handle, metal ends. Price $1.00; but for 30 days we will sell 4 for $3.00, post-paid. Remit in what is most convenient. Send for our 48-page illustrated list, free; also "How to Use a Razor." If we sell you one knife, you will buy of us as long as you live. Fact!
MAHER & GROSH, 40 S Street, Toledo, Ohio.

ASPHALTUM AND THE PITCH LAKE of Trinidad.—By W. O. Crosby. Origin of bitumens, Asphaltum, where found. The pitch lake of Trinidad. How the pitch is quarried. Origin of the lake. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 605. Price 10 cents. To be had at this office and from all newsdealers.

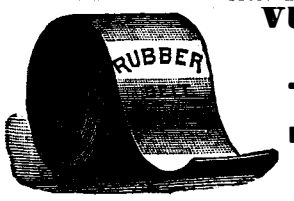


WE MANUFACTURE
WELL DRILLS
FOR
Water, Coal and Gas,
Hydraulic or Jetting.
Largest Stock in America. Farmers with small outlay (*experience unnecessary*), Can make large profits. No risks. Can direct buyers to paying territory. Prospecting for Water, Coal or Gas done on application. Also M'f's of WIND MILLS, HORSE POWERS, FEED MILLS, FODDER AND ENSILAGE CUTTERS, PUMPS AND WELL SUPPLIES. Mention this Paper. Send 14c. to cover cost mailing Catalogue.
CHICAGO
TUBULAR WELL WORKS,
68 W. Lake St., Chicago, Ill.

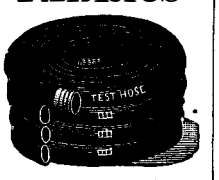
GOVERNMENT BREEDING FARM FOR Cavalry Horses.—A paper by Lieut. S. C. Robertson, U. S. A., outlining a plan for the establishment of a breeding farm for horses maintained and controlled by the government, and discussing the economic features of the scheme. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 606. Price 10 cents. To be had at this office and from all newsdealers.

MODEL and EXPERIMENTAL WORK A SPECIALTY.
Send for Circulars.
C.E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

RUBBER BELTING, PACKING, HOSE.
Oldest and Largest Manufacturers in the United States.



VULCANIZED RUBBER FABRICS
For Mechanical Purposes.
Air Brake Hose
A Specialty.
RUBBER MATS,
RUBBER MATTING
AND STAIR TREADS.



NEW YORK BELTING & PACKING CO., 15 PARK ROW, N. Y.
JOHN H. CHEEVER, Treas., J. D. CHEEVER, Dep'y Treas. Branches: 167 Lake St., Chicago; Denver, Col. 308 Chestnut St., Phila.; 52 Summer St., Boston; AGENTS: PERSICANER & CO., Pickhuben 5, Hamburgh.

THE BARAGWANATH STEAM JACKET
Feedwater Boiler and Purifier.
Boils the feedwater. Keeps the boiler clean. Saves boiler repairs. Saves from 15 to 40 per cent. of fuel. Large heating surface. No radiating surface. No back pressure. Thoroughly utilizes the exhaust. Strong and durable. Over 5,000 in use. Send for circular.
WM. BARAGWANATH & SON, 40 West Division Street, Chicago, Ill.
JAS. B. CROUTHERS, M. E., General Eastern Manager, 112 Liberty Street, New York.

CENTRIFUGAL EXTRACTORS.—BY R. F. Gibson. A concise explanation of the principles underlying the working of these apparatus, and the consideration and laws governing the shape, size, material, etc. With 33 engravings of apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 612 and 613. Price 10 cents each. To be had at this office and from all newsdealers.

WELL Encyclopedia of 700 Engravings of WELL TOOLS, Diamond Drills and Lightning Hydraulic WELL Machines Book free, 25c. for mailing it. American Well Works, Aurora, Ill.

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

The New Catalogue of Valuable Papers
contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, N. Y.

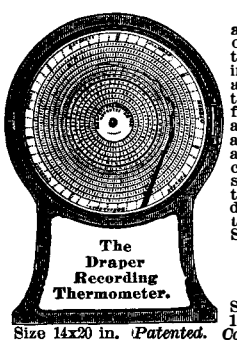
FOR SALE PATENT. By The Adamson Co. Patent Salesmen. Muncie, Ind.

FOUCAULT'S CURRENTS.—A PAPER by Dr. A. Von Waltenhofen, describing a new apparatus for the production of Foucault's currents. With 3 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 605. Price 10 cents. To be had at this office and from all newsdealers.

CURE FOR THE DEAF

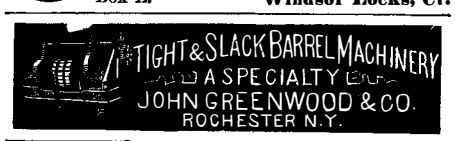
PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS Perfectly Restore the Hearing, whether deafness is caused by colds, fevers or injuries to the natural drums. Invisible, comfortable, always in position. Music, conversation, whispers heard distinctly. Write to F. HISCOX, 853 Broadway, cor. 14th St. New York, for illustrated book of proofs FREE.

The Draper Recording Thermometer.



This thermometer gives a permanent and continuous record in ink of the temperature. The chart indicating hours of the day and days of the week gives the degrees of temperature from 20° below zero to 110° above. All instruments are accurately adjusted and warranted. The record is easily read and absolutely correct. Sold by the leading instrument dealers and opticians throughout the United States and Canada, and by
The DRAPER MANUFACTURING CO.
Owners of the United States and foreign patents, 152 Front Street, New York
Size 14x20 in. *Patented. Copyrighted.*

CLARK'S NOISELESS RUBBER WHEELS
No more Splintered Floors.
Different Styles. Catalogue Free.
GEO. P. CLARK,
Box L. Windsor Locks, Ct.



FIFTY YEARS' PROGRESS IN TELEgraphy.—By W. H. Preece, F.R.S. An interesting historical paper. Improvements in apparatus. Telephones, Pneumatic telegraphs, Cables, Railway telegraps. Capital invested in telegraphs. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 607. Price 10 cents. To be had at this office, and from all newsdealers.

AIR, PURIFICATION OF.—BY D. Prince, M.D. An experimental study in relation to the removal from the air of the dust or particulate material, supposed to produce yellow fever, small-pox, and other infectious disease. 1 illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 569. Price 10 cents. To be had at this office and from all newsdealers.

PATENT RIGHTS FOR SALE.
APPARATUS FOR BUILDING
CONCRETE BUILDINGS AND WALLS.
County Rights, $50. State Rights, $500.
See descriptive notice in SCI. AMERICAN, May 22, 1886. Send for circulars. Ransome, 402 Montgomery St., S.F.Cal.

GLASS.—ABSTRACT OF AN INTERESTing lecture upon the subject, delivered by Sydney Lupton, M.A., before the Leeds Philosophical Society. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

COLEMAN NAT'L BUSINESS COLLEGE, Newark, N. J.
National Patronage, Best Facilities, Best course of Business Training, Shortest Time, Lowest Rates, No Vacation. Address, H. COLEMAN, Pres.

I WANT to buy some specialty patents, or would manufacture on royalty. Give description or send patent. Address F. D. CUMMER, Cleveland, O.

19 Silk and Satin Neckties **FREE.** Agents' snap. Bx and out fit, 12c. NECKTIE CO., Augusta, Me.

HOW TO MAKE AN INCUBATOR.—Full directions, illustrated with 7 figures. Also directions for operating the apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 612. Price 10 cents. To be had at this office and from all newsdealers.

ON 30 DAYS' TRIAL.

THIS NEW
ELASTIC TRUSS
Has a Pad different from all others, is cup shape, with Self-adjusting Ball in center, adapts itself to all positions of the body, while the ball in the cup presses back the intestines just as a person does with the finger. With light pressure the Hernia is held securely day and night, and a radical cure certain. It is easy, durable and cheap. Sent by mail Circulars free. EGGLESTON TRUSS CO., Chicago, Ill.

ICE & REFRIGERATING Machines. York Patent. YORK MFG. CO., York, Pa.

HOME MANAGEMENT

Spons' Household Manual: a treasury of Domestic Receipts. With full instructions for the most healthful and economical arrangement of every department. An every-day book for the careful housewife. 998 pages, with 230 illustrations. Price $3.00, express prepaid. Descriptive circular on application.
E. & F. N. SPON, 35 Murray St., New York.

Proposals for Tools for the Navy Yard, Brooklyn, New York.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 25, 1887.—Sealed proposals will be received at this Department until 12 o'clock noon, on Monday, the sixteenth day of January, 1888, at which time and place they will be opened in the presence of attending bidders, for furnishing tools and materials required by the Bureau of Construction and Repair, and for the delivery of the same at the Navy Yard, Brooklyn, New York. Printed schedules particularly describing the tools, blank forms on which proposals must be made, and all other information essential to bidders can be obtained by regular dealers in, or manufacturers of, the articles required, on application to the Commandant of said Navy Yard. Proposals must be made in duplicate, and enclosed in sealed envelopes marked "Proposals for Tools for the Navy Yard, Brooklyn, New York," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. All bids must be accompanied by either plans or descriptive cuts of the principal tools which the dealer offers to furnish. The Secretary of the Navy reserves the right to reject any or all bids, in whole or in part, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

VALUABLE BOOKS
—FOR—
HOLIDAY PRESENTS.

American Mechanical Dictionary.—A Descriptive Word Book of Tools, Instruments, Machines, Chemical and Mechanical Processes, etc. By E. H. Knight. Three Vols. 8vo $24.00

New Mechanical Dictionary.—A Description of Tools, Instruments, Machines, Processes, and Engineering, with Indexical References to Technical Journals. By E. H. Knight. Illustrated. 8vo.. $9.00
The Four Volumes..... $27.50

Encyclopedia.—Dick's Encyclopedia of Practical Receipts and Processes. Containing 6,422 Practical Receipts. Written in a plain and popular manner, and illustrated with explanatory wood cuts. Being a comprehensive Book of Reference for the Merchant, Manufacturer, Artisan, Amateur, and Housekeeper. Embracing valuable Information in the Arts, Professions, Trades, Manufactures, including Medicine, Pharmacy, and Domestic Economy. Cloth..... $5.00

Machinist, The Complete Practical.—Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Use of Tools, etc. By Joshua Rose. This is one of the very best works issued on the subject. 436 pages, thoroughly revised to date. Illustrated by 356 engravings. 12mo... $2.50

Mechanics' Own Book.—Spons' Mechanics' Own Book. A Manual for Handicraftsmen and Amateurs, complete in one large volume. Demy 8vo, cloth, containing 700 pages and 1,420 illustrations $2.50

Popular Scientific Recreations.—Translated and Enlarged from the French of Gaston Tissandier, and profusely Illustrated. This Book includes the famous series of Experiments in Physics Without Apparatus that have won such wide appreciation in so many households. For the young people no better Christmas present than this elegantly bound and printed book can be imagined. Experiments in Physics and Chemistry, Natural Magic, Electricity, and similar subjects are all treated and very fully illustrated with the most artistic wood cuts. The cuts number upward of 900, and the volume will be found to be a perfect encyclopedia of enjoyment for all. 780 large pages $2.50

Questions and Answers for Engineers.—Contains all the Questions that an Engineer will be asked when undergoing an Examination for the purpose of procuring a License, with the Answers to the same, couched in language so plain that any Engineer or Fireman can in a short time commit them to memory. By Stephen Roper... ..... $3.00

Workshop Receipts.—For the use of Manufacturers, Mechanics, and Scientific Amateurs. The best late Collection published of such a wide variety of Information:

First Series.—Bookbinding, Candles, Drawing, Electro-Metallurgy, Engraving Gilding, Japans, Photography, Pottery, Varnishing, etc. 450 pages, with illustrations. $2.00

Second Series.—Industrial Chemistry, Cements and Lutes, Confectionery, Essences and Extracts, Dyeing, Staining, and Coloring. Gelatine, Glue, and Size, Inks, Paper, and Paper Making, Pigments, Paint, and Painting, etc. $2.00

Third Series.—Alloys, Electrics, Enamels and Glazes, Glass, Gold, Iron, and Steel, Lacquers and Lacquering, Lead, Lubricants, Mercury, Nickel, Silver, Tin, Vanadium, Zinc, etc. 480 pages, 183 illustrations. $2.00

Fourth Series.—Waterproofing, Packing and Storing, Embalming and Preserving, Leather Polishes, Cooling Air and Water, Pumps and Siphons, Desiccating, Distilling, Emulsifying, Evaporating, Filtering, Percolating, and Macerating, Electrotyping, Stereotyping, Bookbinding, Straw Plaiting Musical Instruments, Clock and Watch Mending, Photography, etc. $2.00

☞ In ordering single volumes, be particular to mention the "series" wanted.

☞ *Sent by mail or express on receipt of price.*

☞ *Our large new Catalogue of Books, of 100 pages, embracing works on more than fifty different subjects, mailed free to any address, on application.*

MUNN & CO., 361 Broadway, New York.
Publishers of SCIENTIFIC AMERICAN.

MUSICAL, OPTICAL, ELECTRIC, MECHANICAL WONDERS.
MAGIC LANTERNS & VIEWS
New and S. H. *Catalogue free.* S. H. bought. HARBACH'S, Philada., Pa.

MODELS. SMALL CASTINGS, GEARS, PATTERNS, etc. H. A. GEER, 189 Washington Street, Chicago.

The Scientific American
PUBLICATIONS FOR 1888.

The prices of the different publications are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Export Edition (monthly) one year	5.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement,	$7.00
The Scientific American and Architects and Builders Edition,	5.00
The Scientific American, Supplement, and Architects and Builders Edition,	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

CATARRH positively cured by the great German Remedy. Sample pkge. and book for 4 cts. in stamps. E. H. MEDICAL CO., East Hampton, Conn.

© 1887 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

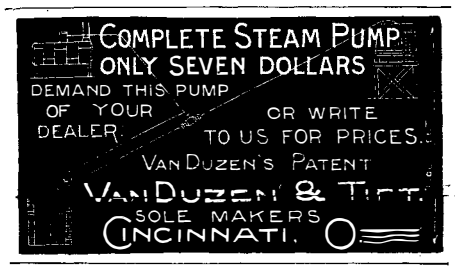
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

STATE RIGHTS FOR SALE.
Valuable Patent for Making Sand Paper. Been tried with perfect success. Address,
LOCK BOX 178, YORK, PA.

THE CHEAPEST AND BEST
PHOTO ENGRAVING CO.
67 PARK PLACE, NEW YORK
ENGRAVING FOR ALL ILLUSTRATIVE AND ADVERTISING PURPOSES

USEFUL BOOKS.

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,
MUNN & CO., 361 Broadway, New York.



Steam! Steam!

We build Automatic Engines from 2 to 200 H. P., equal to anything in market.
A Large Lot of 2, 3 and 4-H. Engines
With or without boilers, **low for cash.**
B. W. PAYNE & SONS,
Box 15, Elmira, N. Y.

MOSS ENGRAVING CO. 535 PEARL ST. cor Elm St NEW YORK
OUR SPECIALTY: FINE ILLUSTRATED CATALOGUES
BY OUR NEW MOSS-TYPE PROCESS
Send Green Stamp for Moss-Type Specimens.

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 1. The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

LE PAGE'S LIQUID GLUE
THE ONLY GENUINE
TESTED TO OVER 1600 LBS. TO THE INCH
Used by thousands of first-class Manufacturers and Mechanics on their best work. Its success has brought a lot of imitators copying us in every way possible. Remember that THE ONLY GENUINE LePage's Liquid Glue is manufactured solely by the
RUSSIA CEMENT CO., GLOUCESTER, MASS
Sample by mail 20c. stamps.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

Scientific American

FOR 1888.

The Most Popular Scientific Paper in the World.

ESTABLISHED 1845.

☞ Circulation Larger than all Papers of its Class Combined.

Only $3.00 a Year, including postage to United States and Canada. $4.00 a year, including postage to all countries in the Postal Union.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind this journal affords a constant supply of instructive reading. It is promotive of knowledge and pro ress in every community where it circulates.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT (see prospectus below) will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of **seven dollars** by the publishers.

The safest way to remit is by Postal Order, Draft, or Postal Note. Money carefully placed inside of envelopes, securely sealed, and correctly addressed seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

Scientific American Supplement

This is a distinct paper from THE SCIENTIFIC AMERICAN, but it is uniform in size with it, every number containing 16 octavo pages. THE SCIENTIFIC AMERICAN SUPPLEMENT embraces a very wide range of contents, covering the most recent and valuable contributions in Science, Mechanics, Architecture, and Engineering from every part of the world. Every number contains several illustrations, consisting in part of important engineering works, in progress or completed, both at home and abroad. It presents the most recent papers by eminent writers in every department of science, and every number contains information useful to engineers in every department of industry, civil, mechanical, electrical, etc.

Translations from French, German, and other foreign journals, accompanied with illustrations of Grand Engineering Works; also of Naval and Mechanical constructions of magnitude, projected, progressing, and completed, at home and in all countries abroad.

The most important papers read at Scientific Conventions by the best and most profound thinkers, will be found in THE SCIENTIFIC AMERICAN SUPPLEMENT. This paper, when preserved and bound, forms a most useful encyclopedia of information, and presents a complete history of the progress of the times in the Sciences, Arts, and Mechanical Engineering. This paper contains no advertisements.

Price—$5 a year, in advance; or one copy of THE SCIENTIFIC AMERICAN (see prospectus above) and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT both mailed for one year for $7, payment in advance to the publishers. Remit by mail and address

MUNN & CO.,
Publishers Scientific American,
361 Broadway, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, THE SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British Colonies; to France, Austria, Belgium, Germany, Russia, and all other European States, Japan, Brazil, and all States of Central and South America. Terms, when sent to foreign countries, Canada and Mexico excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of

MUNN & CO., 361 Broadway, New York.

Architects and Builders Edition

$2.50 a Year. Single Copies, 25 Cents.

This is a Special Trade Edition of THE SCIENTIFIC AMERICAN, issued monthly—on the first day of the month. Each number contains about forty large quarto pages, equal to about two hundred ordinary book pages, forming, practically, a large and spendid **Magazine of Architecture,** richly adorned with *elegant plates in colors* and with fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Costs, Bills of Estimate, and Sheets of Details.

No other building paper contains so many plans, details, and specifications regularly presented as this edition of THE SCIENTIFIC AMERICAN. Hundreds of dwellings have already been erected on the various plans we have issued during the past year, and many others are in process of construction.

Architects, Builders, and Owners will find this work valuable in furnishing fresh and useful suggestions. All who contemplate building or improving homes, or erecting structures of any kind, have before them in this work an almost *endless series of the latest and best examples* from which to make selections, thus saving time and money.

Many other subjects, including Sewerage, Piping, Lighting, Warming, Ventilating, Decorating, Laying out of Grounds, etc., are illustrated. An extensive Compendium of Manufacturers' Announcements is also given, in which the most reliable and improved building Materials, Goods, Machines, Tools, and Appliances are described and illustrated, with addresses of the makers, etc.

The fullness, richness, cheapness, and convenience of this work have won for it the **Largest Circulation** of any Architectural publication in the world. The subscription price of this publication is $2.50 a year, or one copy of the SCIENTIFIC AMERICAN and Architect and Builders Edition to the same address $5. Single numbers mailed, 25 cents. For sale and subscriptions received by all news dealers. Address

MUNN & CO., Publishers,
361 Broadway, New York.

Mention this paper.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 116. Price 10 cents. To be had at this office and of all newsdealers.

PATENT
JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HAND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

NAVAL ARCHITECTURE.—AN INteresting review, by Mr. R. Duncan, of the progress that has been made in this branch of science during the last fifty years. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 589. Price 10 cents. To be had at this office and from all newsdealers.

GEO. W. MARBLE, Sole Manufacturer of THE ACME WRENCH.
The best made, all steel, and warranted, 6 sizes.
28 to 32 South Canal Street, Chicago, U. S. A.

ELECTRIC CONVEYORS.—DESCRIPtion of two ingenious systems for the electric carriage of small packages. Illustrated with 18 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 464. Price 10 cents. To be had at this office and from all newsdealers.

AMERICAN
Leather Link Belt Co.
A new article in Belting which is made of small Leather Links joined together with steel bolts. They have been remarkably successful for hard working machinery and belts run half crossed.
For prices and particulars write to CHAS. A. SCHIEREN & CO., 47 Ferry St., New York; 416 Arch St., Phila.; 86 Federal St., Boston.

The Original Unvulcanized Packing
CALLED THE STANDARD—As it is the Packing by which all others are compared.
Accept no packing as JENKINS PACKING unless stamped with our "Trade Mark."
JENKINS BROS. { 71 John Street, N. Y. 105 Milk Street, Boston. 18 So. Fourth St., Phila. 54 Dearborn St., Chicago.

Shafting and Gearing, Textile Machinery, ELEVATORS, ETC. | THOS. WOOD & CO. 22d and Wood Sts., Philadelphia, Pa.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST. BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

ASK YOUR STATIONER FOR THE
JOHANN FABER LEAD PENCILS
THE BEST NOW MADE

THE NEW CROTON AQUEDUCT.—Detailed description of the great aqueduct now being constructed to increase the water supply of New York City, and also of the great dam which it is proposed to build across the Croton River, at Quaker Bridge. With engravings and a map. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 558. Price 10 cents. To be had at this office and from all newsdealers.

H. W. JOHNS'
ASBESTOS
COVERINGS.
For Furnaces, Hot-Air Pipes, etc.
FIRE-PROOF. NON-CONDUCTING.
33⅓ of Fuel Saved. Has no Odor.
All of the heat is carried to points desired and not wasted in cellars and flues.
H. W. JOHNS M'F'G CO.,
87 MAIDEN LANE, NEW YORK.

VELOCITY OF ICE BOATS. A COLLECtion of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 214. Price 10 cents. To be had at this office and from all newsdealers.

MAGIC LANTERNS.
OUR PETROLEUM LANTERNS HAVE THE FINEST LENSES AND THE LAMPS ARE UNRIVALLED FOR POWERFUL WHITE LIGHT.
CHOICE STOCK OF VIEWS COLORED AND PLAIN
SEND FOR CATALOGUE
QUEEN & CO. PHILADELPHIA PA.

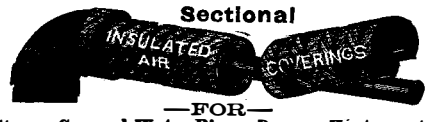
THE ECLIPSE OF ALGOL, WITH THE latest Determinations of its Distance and Dimensions.—By Royal B. Hill. An interesting account of recent studies of the variations in intensity of the star Algol, with a discussion of its orbit and that of its satellite. How a cardboard model of the phenomena of its eclipse may be made. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 558. Price 10 cents. To be had at this office and from all newsdealers.

GOLD MEDAL, PARIS, 1878.
BAKER'S
Breakfast Cocoa.
Warranted *absolutely pure Cocoa,* from which the excess of Oil has been removed. It has *three times the strength* of Cocoa mixed with Starch, Arrowroot or Sugar, and is therefore far more economical, *costing less than one cent a cup.* It is delicious, nourishing, strengthening, easily digested, and admirably adapted for invalids as well as for persons in health.
Sold by Grocers everywhere.
W. BAKER & CO., Dorchester, Mass.

COMPRESSION OF AIR.—DESCRIPtion of Messrs. Dubois & Francois' improved air compressing machine, devised for the use of the larger industries and for mining purposes. With 8 figures, illustrating the apparatus in plan, elevation and detail. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 435. Price 10 cents. To be had at this office and from all newsdealers.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
FINE TINNING JAPANNING AND FINISHING
THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

SHIELDS & BROWN CO.
Manufacturers of
Sectional


—FOR—
Steam, Gas and Water Pipes, Drums, Heaters, etc.
The Best Non-Conductor of Heat & Cold in the World.
Send for Illustrated descriptive Circular, and name this paper.
143 Worth Street, NEW YORK. 78 and 80 Lake St., CHICAGO.

LIGHTNING CONDUCTORS.—DESCRIPtion of a new form of apparatus for testing lightning conductors, and the method of using it. Illustrated with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 596. Price 10 cents. To be had at this office and from all newsdealers.

PRINTING INKS.
THE "Scientific American" is printed with CHAS ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.

© 1887 SCIENTIFIC AMERICAN, INC.